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BULLETIN NO. 39-58

WATER SUPPLY CONDITIONS IN
SOUTHERN CALIFORNIA
DURING 1957-1958

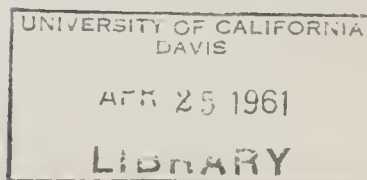
VOLUME I
TEXT

EDMUND G. BROWN
Governor



HARVEY O. BANKS
Director of Water Resources

AUGUST, 1960



STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

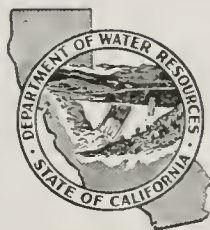
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VOLUMES OF BULLETIN NO. 39-58

Volume I — Text.

Volume II — Precipitation and Water Level Data, Central Coastal, and Los Angeles Regions.

Volume III — Precipitation and Water Level Data, Lahontan, Colorado River Basin, Santa Ana, and San Diego Regions.

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STATE OF CALIFORNIA
Department of Water Resources
SACRAMENTO

Honorable Edmund G. Brown, Governor,
and Members of the Legislature of
the State of California

Gentlemen:

I have the honor to transmit herewith Bulletin No. 39-58, entitled "Water Supply Conditions in Southern California during 1957-58". This report is the latest of the series of annual reports on water supply conditions in Southern California, prepared pursuant to Sections 225 and 226 of the California Water Code.

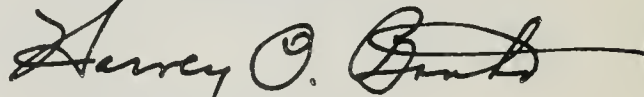
During the water year 1957-58 (October 1, 1957, through September 30, 1958) favorable precipitation resulted in above-normal runoff in most of the streams in Southern California. These conditions partially relieved unfavorable water supply conditions caused by the drought which has prevailed in Southern California since 1944, interrupted only by above-normal precipitation during 1951-52. Precipitation in Southern California in 1957-58 was generally 155 per cent of the mean, and the runoff 165 per cent of the mean.

At the end of the 1958 season, the quantity of water in surface storage reservoirs in coastal Southern California, which are dependent on local runoff, was larger than at the end of the previous season, but storage still remained far below the full stage, reflecting the effects of the prolonged drought. Storage in Lake Mead on the Colorado River increased from 70 to 86 per cent of usable capacity. Ground water levels rose in most ground water basins or declined at a reduced rate. However, sea-water intrusion continued in several important ground water basins in Southern California, among them the Oxnard Plain Pressure Area in Ventura County, West Coast Basin in Los Angeles County, and East Coastal Plain Pressure Area in Orange County.

Honorable Edmund G. Brown, Governor,
and Members of the Legislature of
the State of California - 2

A total of about 870,000 acre-feet of water was imported through the Los Angeles and Colorado River Aqueducts to offset the deficiency of local water supply in coastal Southern California. The amount imported was about seven per cent below the amount imported the previous year. The decrease was due in part to additional local water supply obtained from above-normal precipitation.

Very truly yours,

A handwritten signature in dark ink, appearing to read "Harvey O. Banks", with a long horizontal flourish extending to the right.

HARVEY O. BANKS
Director

FOREWORD

During the preparation of Bulletin No. 39-57, the bulletin immediately preceding the publication herein presented, the Department of Water Resources began adapting its data processing and publication to machine operations. The transition to machine operations, while effecting substantial long term economies of processing time, personnel, and publication costs, resulted in a temporary slowing down of production of the finished product. The new processing methods have now been given a complete "shake down" and it is anticipated that a prompt publication schedule can be followed. Bulletin No. 39-59 will be completed prior to the end of the current calendar year and Bulletin No. 39-60 will be completed during the spring of 1961.

ACKNOWLEDGMENT

Contributions were made and assistance rendered by many public and private agencies and individuals in the preparation of this report.

Special mention is made of the cooperation received from the following:

City of San Bernardino

City of San Diego

Los Angeles County Flood Control District

Los Angeles Department of Water and Power

Orange County Flood Control District

Riverside County Flood Control and Water
Conservation District

San Bernardino County Flood Control District

The Metropolitan Water District of Southern California

United States Geological Survey

United States Weather Bureau

United Water Conservation District

Ventura County Flood Control District

State of California, Office of Controller, Division
of Disbursements

Eleventh Naval District, Public Works Office

The Office of State Controller carried out the machine processing by which basic data in this report were prepared for publication.

The Department of Water Resources gratefully acknowledges the assistance of these agencies without which preparation of the report would have been much more difficult and time consuming.

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STATE DEPARTMENT OF WATER RESOURCES

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CHAPTER I. INTRODUCTION

This report is the latest in the Bulletin No. 39 series, which has been published annually since 1932. The report contains discussion of water supply conditions in the Southern California area for the season of 1957-58 and supporting basic data compiled during that season by the Department of Water Resources and numerous other water agencies operating in the area. Data concerning precipitation, surface stream flow, and underground waters, including consideration of both the quantity and quality of these resources are presented. Information on the activities of numerous operating water agencies is included. The material presented herein is intended for the use of water agencies and the public in management of current and continuing surface and underground water operations.

The 1957-58 season was the first above-normal water supply year in Southern California since 1951-52, and the second since the beginning of the current drought period in 1944. As a result of the above-normal water crop a noticeable improvement in the water supply conditions occurred. The above-normal rainfall and runoff during this season increased local water stored in surface reservoirs and water levels in many of the ground water basins rose. Despite this partial recovery, however, water levels in many of the major coastal basins remained below sea level, and conditions favorable to the intrusion of sea water continued.

Despite the above-normal water supply available from local sources, it was necessary to continue the importation of major quantities of water. Approximately 870,000 acre-feet were brought into coastal Southern California

during the 1957-58 water year from Owens River and Mono Basin by the City of Los Angeles and from the Colorado River by The Metropolitan Water District of Southern California.

Authorization

Division 1 of the California Water Code contains general authorization for the activity of the Department of Water Resources related to compilation of the material presented in this report. Pertinent Sections 225 and 226 of the Code are quoted as follows:

"225. The department may carry on topographic surveys and investigations into matters pertaining to the water resources of the State along the lines of hydrography, hydroeconomics, and the use and distribution of water for agricultural purposes, and to that end, where possible and to the best interest of the State, shall enter into contracts for cooperation with the different departments of the Federal Government. The department, with the consent of the Governor, may maintain and continue such surveys and investigations where there is available money not covered by cooperative contract.

"226. The department, either independently or in cooperation with any person or any county, state, federal, or other agency, may do any of the following:

(a) Conduct investigations of all or any portion of any stream, stream system, lake or other body of water.

(b) Investigate either or both surface and underground water conditions.

(c) Collect records of diversion and use of water.

(d) Supervise distribution of water in accordance with agreements and court orders therefor.

(e) Conduct investigations of the rate of use of water for various purposes and considering various soil conditions. (Amended by Stats. 1959, Ch. 2090)"

The California Legislature of 1929 enacted legislation designated Chapter 832, Statutes of 1929, which is quoted in part as follows:

"SECTION 1. Out of any money in the state treasury not otherwise appropriated, the sum of four hundred fifty thousand dollars, or so much thereof as may be necessary, is hereby appropriated to be expended by the state department of public works in accordance with law in conducting work of exploration, investigation and preliminary plans in furtherance of a coordinated plan for the conservation, development and utilization of the water resources of California including the Santa Ana river and its tributaries, the Mojave river and its tributaries, and all other water resources of southern California."

Portions of funds appropriated by subsequent sessions of the Legislature for support of the Division of Water Resources and its successor, the Department of Water Resources, have been expended for continuing investigations of the water resources of Southern California, as authorized in Division 1 of the Water Code.

Prior Reports

The first bulletin No. 39, entitled "Records of Ground Water Levels at Wells", was published in 1932. Since then, water levels at selected wells have been published annually in Bulletins Nos. 39-A through 39-W, the last of the lettered series of reports, and in Bulletins Nos. 39-56 and 39-57. There was no interruption in the continuity of data between the lettered and numbered series. Seasonal precipitation data from United States Weather Bureau records, as well as from records at stations not included in official publications of that agency, were first published in Bulletin No. 39-A and have since appeared in all subsequent publications of the series.

The scope of the early reports of the Bulletin No. 39 series was somewhat limited. Records were first published of ground water levels and precipitation data in the Santa Ana, San Gabriel, and Los Angeles River

Valleys, and the West and South Coastal Plains. In later reports, the area covered was extended to include the San Jacinto and Antelope Valleys. A general summary of the water supply of the entire southern portion of the State was published in the 1948 publication. This summary contained information on precipitation, runoff, surface reservoir storage, importations of water, water quality, and changes in ground water levels. In 1956 the period covered by the reports was changed from the calendar to the fiscal year, permitting more rapid dissemination of data.

Beginning with Bulletin No. 39-57, the area encompassed by the report was expanded to include the entire area of responsibility of the Southern California District of the Department, as delineated on Plate 1, and an area-wide summary of conditions was included in each annual report. To provide a more complete description of water supply conditions, discussions of such additional items as sea-water intrusion, weather modification operations, outflow to the ocean, and sewage discharge to the ocean were included.

Other bulletins covering various aspects of the hydrology of the Southern California area have been published by the Department of Water Resources and predecessor agencies since 1930. These publications include data on water use, ground water levels, quality of water, value and cost of water for irrigation, water losses and evaporation data, underground geology, and overdraft from ground water basins in Southern California. These bulletins are:

California State Department of Public Works, Division of Water Resources. "Santa Ana River Basin". Bulletin No. 31. 1930.

California State Department of Public Works, Division of Water Resources. "South Coastal Basin, A Symposium". Bulletin No. 32. 1930.

California State Department of Public Works, Division of Water Resources. "Rainfall Penetration and Consumptive Use of Water in Santa Ana River Valley and Coastal Plain". Bulletin No. 33. 1930.

California State Department of Public Works, Division of Water Resources. "South Coastal Basin Investigation, Quality of Irrigation Waters". Bulletin No. 40. 1933.

California State Department of Public Works, Division of Water Resources. "South Coastal Basin Investigation, Detailed Analyses Showing Quality of Irrigation Waters". Bulletin No. 40-A. 1933.

California State Department of Water Resources. "Quality of Surface and Ground Waters in Upper Santa Ana Valley". Bulletin No. 40-57. June, 1957.

California State Department of Public Works, Division of Water Resources. "South Coastal Basin Investigation, Value and Cost of Water for Irrigation in Coastal Plain of Southern California". Bulletin No. 43. 1933.

California State Department of Public Works, Division of Water Resources. "South Coastal Basin Investigation, Water Losses Under Natural Conditions from Wet Areas in Southern California". Bulletin No. 44. 1933.

California State Department of Public Works, Division of Water Resources. "South Coastal Basin Investigation, Geology and Ground Water Storage Capacity of Valley Fill". Bulletin No. 45. 1934.

California State Department of Public Works, Division of Water Resources. "South Coastal Basin Investigation, Overdraft on Ground Water Basins". Bulletin No. 53. 1947.

California State Department of Public Works, Division of Water Resources. "Report to the Assembly of the State Legislature on Water Supply of Antelope Valley in Los Angeles and Kern Counties". May, 1947.

California State Department of Public Works, Division of Water Resources. "Southern California Area Investigation, Memorandum Report on Water Conditions in Antelope Valley in Kern, Los Angeles and San Bernardino Counties". February, 1955.

California State Department of Water Resources, Division of Resources Planning. "Sea-Water Intrusion in California", Bulletin No. 63. November, 1958.

Scope of Activity and Report

The activity of the Department of Water Resources in preparation of this report was principally that of compiling the information from the various organizations and individuals who make the actual field measurements. The Department measured water levels at about 390 wells during 1957-58, in addition to those measured in connection with watermaster service. Otherwise, all measurements presented herein were made by other agencies and individuals.

This bulletin has three volumes. Volume I contains a general summary of water supply conditions in Southern California, presented in four succeeding chapters - one on surface water supplies, the second on ground water supply, the third on water quality, and the fourth on construction activities affecting water supply. Sixteen plates, which illustrate the material presented herein, are bound in this volume.

Volume II contains Appendix A, "Records of Seasonal Precipitation at Stations in Central Coastal Region No. 3 and Los Angeles Region No. 4"; Appendix B, "Records of Ground Water Levels at Wells in Central Coastal Region No. 3"; and Appendix C, "Records of Ground Water Levels at Wells in Los Angeles Region No. 4".

Volume III contains Appendix D, "Records of Seasonal Precipitation at Stations in Lahontan Region No. 6, Colorado River Basin No. 7, Santa Ana Region No. 8, and San Diego Region No. 9"; Appendix E, "Records of Ground Water Levels at Wells in Lahontan Region No. 6"; Appendix F, "Records of Ground Water Levels at Wells in Colorado River Basin Region No. 7"; Appendix G, "Records of Ground Water Levels at Wells in Santa Ana Region No. 8"; and Appendix H, "Records of Ground Water Levels at Wells in San Diego Region No. 9".

Definition of Seasons

In the description of water supply conditions presented in ensuing chapters of this report, a number of periods or seasons are referred to. These depend upon the type of data being described, as discussed below.

Surface Runoff

Surface runoff data are referred to the water year which comprises the 12-month period October through September. Artificial recharge, import, reservoir storage, and sewage discharge data are also related to this period.

Precipitation

Precipitation data are referred to the 12-month period July through June. This conforms to standard United States Weather Bureau practice.

Ground Water Levels

Ground water level data are generally related to the period summer to summer in this report. This generally corresponds to the period July through June. The reason for the use of this period relates to the fact that essentially all ground water data which were collected from local agencies were obtained during the summer, when additional assistance is available. In some instances, particularly when only semiannual or annual measurements are obtained, the period referred to is spring to spring or the period when the measurements are made. Where such deviations are made, appropriate notes are provided.

Numbering System Designations

To facilitate machine procedures for presentation of basic hydrologic data published in this report, codes were adopted and used to designate hydrologic areas, precipitation stations and wells. These codes are described in the following paragraphs.

Areal Designation Code

The areal designation code is based on a decimal numbering system using the form x-xx.xx. The number to the left of the dash refers to the geographic region as defined in Section 13040 of the State Water Code. The two digits to the left of the decimal point refer to a hydrologic unit, which generally comprises a major watershed, including area overlying both water-bearing and nonwater-bearing formations. For simplification, the designation is also given to hydrologic unit groups of small adjacent watershed areas with similar hydrologic conditions which drain directly to the ocean. An example of the latter is the Malibu Hydrologic Unit. The two digits to the right of the decimal point refer to a subunit within the hydrologic unit, including, as before, areas overlying both water-bearing and nonwater-bearing formations. The locations and numerical codings for the hydrologic units and subunits within the area treated in this report are shown on Plates 6 through 11.

Precipitation Station Designation

Precipitation stations are designated by their longitude and latitude to the nearest second. This gives the location of the station within an accuracy range of about 100 feet.

Well Numbering System

The well numbering system found in this report is that utilized by the United States Geological Survey, and adopted by the Department of Water Resources.

Once the township, range, and section are found, each section is divided into 40-acre plots, called lots, lettered as follows:

| | | | |
|---|---|---|---|
| D | C | B | A |
| E | F | G | H |
| M | L | K | J |
| N | P | Q | R |

Within each of these lots, wells are numbered according to the order in which they were assigned State Well Numbers. For example, a well which has the number 10N/18E-26A1_S, would be in Township 10 North, Range 18 East, Section 26, San Bernardino Base and Meridian, and would be the first well assigned a State Well Number in Lot A. In this report, well numbers are referenced either to the San Bernardino Base and Meridian (S) or to the Mount Diablo Base and Meridian (M).

For some wells, the letter following the section number is "X". This means that although the well has been field located and its position accurately plotted with respect to other features in its neighborhood, the map control for the Public Land Survey which is currently available is too poor to warrant assignment of an accurate lot letter.

The 1957-58 season produced a water supply substantially above-normal. This was the first such season since 1951-52, and the second since 1944, the beginning of the current drought period. The following pages discuss the manifestation of this above-normal season in terms of precipitation, runoff, storage in surface reservoirs, imports, runoff to the ocean, and sewage discharges to the ocean.

Precipitation

During the summer months of 1957, there was no significant rainfall in the Southern California area although scattered high-intensity thunder-showers occurred in the desert areas. Above-normal rainfall occurred during October, but November and December were relatively dry and the cumulative rainfall from July through January, 1958, was well below normal. During the ensuing months of February and March of 1958, large quantities of precipitation fell, but the ensuing period to June 30, 1958, showed characteristically low precipitation. The fluctuation in precipitation as the 1957-58 season progressed is indicated by the data in Table 1, which shows the cumulative monthly precipitation for this season and for the 50-year mean period 1897-1947 for stations at Santa Maria, Los Angeles, San Diego, and Barstow.

The over-all precipitation throughout the area for 1957-58 was well above the mean seasonal rainfall experienced during the period 1897-1947. Precipitation varied from less than 100 per cent of this mean in the Mono Valley to more than 200 per cent of the mean in southeastern Ventura County. The areal distribution of the precipitation is indicated by lines of equal precipitation in per cent of the 1897-1947 mean delineated on Plate 2, entitled "Precipitation During 1957-58 in Per Cent of Mean Rainfall". The measured

TABLE 1

CUMULATIVE MONTHLY PRECIPITATION
AT SANTA MARIA, LOS ANGELES
SAN DIEGO AND BARSTOW

| Month | : Cumulative monthly precipi- : : tation at Santa Maria : : 50-year : 1957-58 Season : In : : mean, : In : per cent : 1897-1947, : In : : in inches : inches : of mean : in inches : | | | | : Cumulative monthly precipi- : : tation at Los Angeles : : 50-year : 1957-58 Season : In : : mean, : In : per cent : 1897-1947, : In : : in inches : inches : of mean : in inches : | | | | : Cumulative monthly precipi- : : tation at San Diego : : 50-year : 1957-58 Season : In : : mean, : In : per cent : 1897-1947, : In : : in inches : inches : of mean : in inches : | | | | : Cumulative monthly precipi- : : tation at Barstow : : 50-year : 1957-58 Season : In : : mean, : In : per cent : 1897-1947, : In : : in inches : inches : of mean : in inches : | | | |
|-----------|--|-------|------|-------|--|-------|-------|-------|--|-------|-------|-------|--|-------|-------|-------|
| | 0.01 | 0.02 | 0.03 | 0.04 | 0.05 | 0.06 | 0.07 | 0.08 | 0.09 | 0.10 | 0.11 | 0.12 | 0.13 | 0.14 | 0.15 | 0.16 |
| | 0.06 | 0.03 | 0.05 | 0.02 | 0.01 | 0.03 | 0.04 | 0.06 | 0.07 | 0.09 | 0.10 | 0.12 | 0.13 | 0.15 | 0.16 | 0.18 |
| | 0.28 | 0.05 | 0.23 | 0.18 | 0.31 | 0.90 | 1.96 | 4.46 | 7.41 | 10.78 | 13.45 | 14.40 | 14.74 | 14.81 | 15.52 | 15.76 |
| July | 0.01 | 0.02 | 0.03 | 0.04 | 0.05 | 0.06 | 0.07 | 0.08 | 0.09 | 0.10 | 0.11 | 0.12 | 0.13 | 0.14 | 0.15 | 0.16 |
| August | 0.06 | 0.03 | 0.05 | 0.02 | 0.01 | 0.03 | 0.04 | 0.06 | 0.07 | 0.09 | 0.10 | 0.12 | 0.13 | 0.15 | 0.16 | 0.18 |
| September | 0.28 | 0.05 | 0.23 | 0.18 | 0.31 | 0.90 | 1.96 | 4.46 | 7.41 | 10.78 | 13.45 | 14.40 | 14.74 | 14.81 | 15.52 | 15.76 |
| October | 0.90 | 1.23 | 1.37 | 1.51 | 1.68 | 1.84 | 2.02 | 2.24 | 2.47 | 2.70 | 2.93 | 3.16 | 3.39 | 3.62 | 3.85 | 4.08 |
| November | 1.91 | 1.59 | 83 | 2.02 | 103 | 1.61 | 2.72 | 4.10 | 5.51 | 6.92 | 8.33 | 9.74 | 11.15 | 12.56 | 13.97 | 15.38 |
| December | 4.08 | 3.71 | 91 | 4.16 | 93 | 3.59 | 4.10 | 4.72 | 5.34 | 5.96 | 6.58 | 7.20 | 7.82 | 8.44 | 9.06 | 9.68 |
| January | 7.09 | 6.17 | 87 | 6.24 | 84 | 5.51 | 4.72 | 4.10 | 3.59 | 3.08 | 2.57 | 2.06 | 1.55 | 1.04 | 0.53 | 0.02 |
| February | 9.72 | 10.84 | 112 | 12.70 | 118 | 7.67 | 7.87 | 8.07 | 8.27 | 8.47 | 8.67 | 8.87 | 9.07 | 9.27 | 9.47 | 9.67 |
| March | 12.15 | 15.52 | 128 | 18.00 | 134 | 9.32 | 11.85 | 14.38 | 16.91 | 19.44 | 21.97 | 24.50 | 27.03 | 29.56 | 32.09 | 34.62 |
| April | 13.05 | 19.76 | 151 | 21.09 | 146 | 10.05 | 13.50 | 16.95 | 20.40 | 23.85 | 27.30 | 30.75 | 34.20 | 37.65 | 41.10 | 44.55 |
| May | 13.43 | 19.97 | 149 | 21.13 | 144 | 10.32 | 13.90 | 17.35 | 20.80 | 24.25 | 27.70 | 31.15 | 34.60 | 38.05 | 41.50 | 44.95 |
| June | 13.52 | 19.97 | 148 | 21.13 | 143 | 10.36 | 13.90 | 17.35 | 20.80 | 24.25 | 27.70 | 31.15 | 34.60 | 38.05 | 41.50 | 44.95 |

seasonal precipitation in both inches and per cent of mean for selected stations in Southern California is given in Table 2. In order to illustrate the wide fluctuations of precipitation in the area, the historical seasonal precipitation and its accumulated deviation from the 50-year mean are delineated on Plate 3 for Santa Maria, Los Angeles, San Diego, and Barstow.

TABLE 2

PRECIPITATION AT
SELECTED STATIONS IN SOUTHERN CALIFORNIA
FOR THE 1957-58 SEASON

| Station | County | 50-year mean | 1957-58 Season | |
|-----------------|-----------------|-------------------------|----------------|------------------------|
| | | 1897-1947, in inches | In inches | In per cent of mean |
| San Luis Obispo | San Luis Obispo | 21.68 | 34.35 | 158 |
| Paso Robles | San Luis Obispo | 15.82 | 25.11 | 159 |
| Santa Maria | Santa Barbara | 13.52 | 19.97 | 148 |
| Santa Barbara | Santa Barbara | 18.56 | 31.94 | 172 |
| Ventura | Ventura | 15.59 | 25.65 | 165 |
| Los Angeles | Los Angeles | 14.81 | 21.13 | 143 |
| Pomona | Los Angeles | 18.21 | 32.47 | 178 |
| Santa Ana | Orange | 14.16 | 21.82 | 154 |
| San Bernardino | San Bernardino | 17.21 | 26.84 | 156 |
| Bishop | Inyo | 6.14 | 7.89 | 129 |
| Barstow | San Bernardino | 4.17 | 5.61 | 134 |
| Blythe | Riverside | 4.03 | 6.45 | 160 |
| Brawley | Imperial | 2.40 | 3.28 | 137 |
| Oceanside | San Diego | 12.38 | 16.42 | 133 |
| San Diego | San Diego | 10.36 | 13.90 | 134 |

In the paragraphs which follow, summary information is presented concerning precipitation in each of the regions in the Southern California area, together with a discussion of weather modification operations.

Central Coastal Region No. 3
Santa Barbara and San Luis Obispo Counties

The average of precipitation indexes for the 1957-58 season for groups of stations in hydrologic units of the Central Coastal Region, which

are shown on Table 3, vary from a maximum of 187 per cent of the mean in the Arroyo Grande Group to a minimum of 151 per cent of the mean in the Salinas Valley. The average of precipitation indexes for stations in the portion of the region within the Southern California area was 168 per cent of the mean. Measured seasonal precipitation at City of San Luis Obispo was 34.35 inches, which is 158 per cent of the mean, while precipitation at City of Santa Barbara was 31.94 inches, or 172 per cent of the mean.

TABLE 3

AVERAGE OF PRECIPITATION INDEXES FOR STATIONS IN
HYDROLOGIC UNITS IN CENTRAL COASTAL REGION NO. 3
FOR THE 1957-58 SEASON

| Hydrologic unit | Unit code no. | Number of stations | Average index |
|---|------------------|-----------------------|------------------|
| Salinas Valley | 3- 4.00 | 8 | 151 |
| San Luis Obispo Group | 3- 8.00 | 2 | 178 |
| Arroyo Grande Group | 3-11.00 | 2 | 187 |
| Santa Maria River Valley | 3-12.00 | 5 | 166 |
| Cuyama River Valley | 3-13.00 | 2 | 184 |
| San Antonio Creek Valley | 3-14.00 | 2 | 179 |
| Santa Ynez River Valley | 3-15.00 | 5 | 174 |
| South Coast Basins, Santa Barbara County | 3-16.00 | 3 | 179 |
| Carrizo Plain | 3-19.00 | 3 | 158 |
| Southern Central Coastal Region | | 32 | 168 |

In January, 1957, the Santa Barbara Weather Modification Project, a cooperative investigation, was initiated in Santa Barbara County to test statistically the effectiveness of weather modification operations. The main participants in this project were the Department of Water Resources, University of California, County of Santa Barbara, and North American Weather Consultants. This project was active during 1957-58, the second year of operation. Ground

based silver iodide smoke generators were used to seed all storms during December, 1957, and storms selected at random during the months of January through April, 1958. The generators were run during the 1957-58 season for a total of 2,264 hours. The results of this experimental program have not as yet been fully evaluated.

Los Angeles Region No. 4

Indexes for the 225 stations in the Los Angeles Region indicate that precipitation for the 1957-58 season averaged 161 per cent of the mean for the 50-year period 1897-98 through 1946-47. Average indexes for the individual hydrologic units in the region, presented in Table 4, ranged from a maximum of 209 per cent of mean in Conejo Valley in Southern Ventura County to a minimum of 138 per cent of mean in Acton Valley in the northeastern part of the region near the headwaters of the Santa Clara River. The measured seasonal precipitation at the United States Weather Bureau Station in Los Angeles was 21.13 inches, or 143 per cent of mean.

TABLE 4

AVERAGE OF PRECIPITATION INDEXES FOR STATIONS IN
HYDROLOGIC UNITS IN LOS ANGELES REGION NO. 4
FOR THE 1957-58 SEASON

| Hydrologic unit | : Unit : code no. | : Number of : stations | : Average : index |
|---|----------------------|---------------------------|----------------------|
| Upper Ojai Valley | 4- 1.00 | 3 | 175 |
| Ojai Valley | 4- 2.00 | 1 | 189 |
| Ventura River Valley | 4- 3.00 | 6 | 188 |
| Santa Clara River Valley | 4- 4.00 | 24 | 182 |
| Acton Valley | 4- 5.00 | 4 | 138 |
| Pleasant Valley | 4- 6.00 | 2 | 170 |
| Arroyo Santa Rosa Valley | 4- 7.00 | 1 | 196 |
| Las Posas Valley | 4- 8.00 | 6 | 186 |
| Simi Valley | 4- 9.00 | 2 | 182 |
| Conejo Valley | 4-10.00 | 1 | 209 |
| Coastal Plain, Los Angeles County | 4-11.00 | 62 | 157 |
| San Fernando Valley | 4-12.00 | 32 | 153 |
| San Gabriel Valley | 4-13.00 | 71 | 152 |
| Upper Santa Ana Valley, Los Angeles County | 4-14.00 | 7 | 183 |
| Malibu Coastal Group | 4-16.00 | 3 | 170 |
| Los Angeles Region | | 225 | 161 |

Weather modification operations were conducted in both Los Angeles and Ventura Counties during the 1957-58 season. In Ventura County 2,476 generator hours were logged between December, 1957, and April, 1958, in connection with a project designed to increase precipitation throughout the entire county. The Los Angeles County Flood Control District logged 388 generator hours during the period January through September, 1958, seeding clouds over the San Gabriel Mountains above San Gabriel Dam. Ground based silver iodide smoke generators were used in both counties.

The averages of indexes of precipitation for groups of stations in the Lahontan Region indicate that the 1957-58 season averaged 153 per cent of the mean for the region as a whole. Table 5 presents these data. It also shows that the number of stations in many of the hydrologic units is very limited. In many units there are no available data and indexes are not shown. Mono Valley, in the extreme northern part of this region, had an average precipitation index, based upon two stations, of 64 per cent. This was the only hydrologic unit within the Southern California area recording less than normal rainfall during the 1957-58 season.

TABLE 5

AVERAGE OF PRECIPITATION INDEXES FOR STATIONS IN
HYDROLOGIC UNITS IN LAHONTAN REGION NO. 6
FOR THE 1957-58 SEASON

| Hydrologic unit | : Unit : code no. | : Number of : stations | : Average : index |
|-----------------------------|----------------------|---------------------------|----------------------|
| Mono Valley | 6- 9.00 | 2 | 64 |
| Long Valley | 6-11.00 | 1 | 129 |
| Owens Valley | 6-12.00 | 10 | 142 |
| Deep Springs Valley | 6-15.00 | 1 | 183 |
| Death Valley | 6-18.00 | 1 | 103 |
| Riggs Valley | 6-23.00 | 1 | 170 |
| Ivanpah Valley | 6-30.00 | 1 | 152 |
| Lower Mojave River Valley | 6-40.00 | 1 | 157 |
| Middle Mojave River Valley | 6-41.00 | 1 | 135 |
| Upper Mojave River Valley | 6-42.00 | 2 | 139 |
| Antelope Valley | 6-44.00 | 19 | 172 |
| Fremont Valley | 6-46.00 | 2 | 178 |
| Searles Valley | 6-52.00 | 1 | 144 |
| Rose Valley | 6-56.00 | 2 | 141 |
| Southern Lahontan Region | | 45 | 153 |

Weather modification operations to increase precipitation were conducted by the California Electric Power Company in the vicinity of Bishop Creek watershed, using airborne methods of dispersion. Total seeding time amounted to 11 generator hours using silver iodide and 1.5 hours using dry ice. The operations occurred between October, 1957, and July, 1958.

Colorado River Basin Region No. 7

Indexes of seasonal precipitation for stations in the Colorado River Basin Region are shown in Table 6. They indicate regional precipitation was above average for the 1957-58 season, averaging 139 per cent of the mean for the 50-year period 1897-1947. In Coachella Valley the average of precipitation indexes was 137 per cent of the mean, and in the Imperial Valley it was 153 per cent of the mean. Measured precipitation was 6.45 inches at Blythe and 3.28 inches at Brawley, representing 160 per cent and 137 per cent of the mean for these stations, respectively. Available data are extremely limited. In over two-thirds of the Units there are no data at all and indexes are not shown.

TABLE 6

AVERAGE OF PRECIPITATION INDEXES FOR STATIONS IN
HYDROLOGIC UNITS IN COLORADO RIVER BASIN REGION NO. 7
FOR THE 1957-58 SEASON

| Hydrologic unit | : Unit : code no. | : Number of : stations | : Average : index |
|------------------------------------|----------------------|---------------------------|----------------------|
| Ward Valley | 7- 3.00 | 1 | 152 |
| Chuckawalla Valley | 7- 5.00 | 1 | 114 |
| Lucerne Valley | 7-19.00 | 1 | 112 |
| Morongo Valley | 7-20.00 | 3 | 163 |
| Coachella Valley | 7-21.00 | 5 | 137 |
| Borrego Valley | 7-24.00 | 1 | 118 |
| Terwilliger Valley | 7-26.00 | 1 | 152 |
| Vallecito-Carrizo Valley | 7-28.00 | 1 | 105 |
| Imperial Valley | 7-30.00 | 4 | 153 |
| Orcopia Valley | 7-31.00 | 1 | 107 |
| East Salton Sea Valley | 7-33.00 | 1 | 141 |
| Palo Verde Valley | 7-38.00 | 2 | 143 |
| Calzona Valley | 7-41.00 | 1 | 136 |
| Needles Valley | 7-44.00 | 1 | 128 |
| Colorado River Basin Region | | 24 | 139 |

There were no weather modification operations reported within the Colorado River Basin during the 1957-58 season.

Santa Ana Region No. 8

The 1957-58 seasonal precipitation in the Santa Ana Region was substantially above the long-time mean. The average index for the region, based upon 79 stations, was 157 per cent of normal. However, as Table 7 shows, most of the stations are located in the Coastal Plain of Orange County or in the Upper Santa Ana Valley, where precipitation averaged 169 per cent of mean and 147 per cent of mean, respectively. Measured seasonal precipitation at the United States Weather Bureau Station in the City of Santa Ana was 21.82 inches, or 154 per cent of the mean.

TABLE 7

AVERAGE OF PRECIPITATION INDEXES FOR STATIONS IN
HYDROLOGIC UNITS IN SANTA ANA REGION NO. 8
FOR THE 1957-58 SEASON

| Hydrologic unit | Unit : code no. | Number of : stations | Average : index |
|---------------------------------|--------------------|-------------------------|--------------------|
| Coastal Plain, Orange County | 8- 1.00 | 14 | 169 |
| Upper Santa Ana Valley | 8- 2.00 | 41 | 147 |
| Cajalco Valley | 8- 3.00 | 1 | 151 |
| Elsinore Valley | 8- 4.00 | 1 | 140 |
| San Jacinto Valley | 8- 5.00 | 1 | 175 |
| Bear Valley | 8- 9.00 | 1 | 166 |
| Santa Ana Region | | 79 | 157 |

Weather modification operations were conducted in the Upper Santa Ana Valley by the Santa Ana Weather Corporation. Ground based coke-burning silver iodide generators were operated for a total of 3,273 hours between October, 1957, and May, 1958.

San Diego Region No. 9

The average of indexes of precipitation for the 1957-58 season for 32 stations in the San Diego Region was 149 per cent of the mean. However, as shown in Table 8, the percentage by which the precipitation exceeded the mean decreased from a maximum of 183 per cent in the San Juan Valley, in the northwestern corner of the region, to a minimum of 125 per cent of mean in the Jamul Valley, in the southeastern corner of the region, next to the Mexican Border. At the City of San Diego, measured seasonal precipitation totaled 13.90 inches, or 134 per cent of the mean. No weather modification operation was reported in San Diego County during the 1957-58 season.

TABLE 8

AVERAGE OF PRECIPITATION INDEXES FOR STATIONS IN
HYDROLOGIC UNITS IN SAN DIEGO REGION NO. 9
FOR THE 1957-58 SEASON

| Hydrologic unit | : Unit : code no. | : Number of : stations | : Average : index |
|------------------------|----------------------|---------------------------|----------------------|
| San Juan Valley | 9- 1.00 | 3 | 183 |
| Santa Margarita Valley | 9- 4.00 | 6 | 154 |
| Coahuila Valley | 9- 6.00 | 1 | 151 |
| San Luis Rey Valley | 9- 7.00 | 4 | 168 |
| Warner Valley | 9- 8.00 | 3 | 134 |
| San Pasqual Valley | 9-10.00 | 1 | 146 |
| Santa Maria Valley | 9-11.00 | 1 | 141 |
| Mission Valley | 9-14.00 | 5 | 137 |
| San Diego River Valley | 9-15.00 | 3 | 129 |
| Sweetwater Valley | 9-17.00 | 3 | 145 |
| Tia Juana Valley | 9-19.00 | 1 | 131 |
| Jamul Valley | 9-20.00 | 1 | 125 |
| San Diego Region | | 32 | 149 |

Runoff

Runoff in Southern California streams is generally responsive to the amount and intensity of precipitation. Discharge from mountain areas during the 1957-58 water year was generally above the mean for the 53-year period 1894-95 through 1946-47. Following the precipitation pattern, runoff during the first four months of the 1957-58 water year was generally below normal, followed by a sharp increase during the months of February through April. The estimated seasonal natural runoff at Arroyo Seco near Pasadena was 154 per cent of the 53-year mean. Values for the Santa Ana River near Mentone, Sespe Creek near Fillmore, and Huasna River near Santa Maria were 124 per cent, 240 per cent, and 241 per cent of the mean, respectively.

The estimated seasonal natural runoff during the 1957-58 season for selected stations representative of conditions in Southern California is presented in Table 9, together with a comparison of estimated or measured maximum and minimum runoff for each station with the 53-year mean for the stream in question. The historical seasonal natural runoff of selected streams for the period 1894 to the present and the accumulated deviation of this runoff from the long-time mean are delineated on Plate 4.

In contrast to the rest of the Southern California area, the runoff in streams in the southern portion of San Diego County was below normal during the 1957-58 season. This is apparently related to the previously noted fact that rainfall in this area was relatively less than in most other parts of Southern California, and to the extremely dry conditions of the watersheds as a result of extended drought conditions in previous years. The estimated seasonal natural runoff of Cottonwood Creek at Morena Dam was less than 25 per cent of the mean for the 53-year period, 1894-95 through 1946-47, while Santa Ysabel Creek at Sutherland Dam was 96 per cent of the mean.

Runoff in streams in and adjacent to the easterly desert areas was generally above normal. The estimated seasonal natural runoff of Owens River below Long Valley was 174,500 acre-feet, or 106 per cent of the 53-year mean. Runoff in Rock Creek, as measured near Valyermo, was 167 per cent of mean. It is interesting to note that a discharge of 2,450 cfs was measured in the Mojave River at Barstow on April 4, 1958, and the total seasonal discharge is estimated to be about 20,000 acre-feet. Flow extended the full length of the river during portions of the season reportedly for the first time in 15 years. The unadjusted seasonal runoff in the Colorado River as measured at Lee's Ferry, Arizona, was 102 per cent of normal.

TABLE 9

ESTIMATED NATURAL RUNOFF
SELECTED STATIONS IN SOUTHERN CALIFORNIA
FOR THE 1957-58 SEASON

In Acre-Feet

| Region and Station | Period : of record : | 53-Year : mean ^a : | Maximum ^b | | Minimum ^b | |
|---|-------------------------|----------------------------------|----------------------|--------------------------|----------------------|-------------------------|
| | | | : Season : | Quantity : | : Season : | Quantity : |
| <u>Central Coastal Region</u> | | | | | | |
| Arroyo Grande Creek at Arroyo Grande | 1939 to date | 45,750 ^c | 1906-07 | 76,200 | 1930-31 | 800 |
| Huachuca River near Santa Maria | 1929 to date | 4,740 | 1906-07 | 74,400 | 1928-29 | 0 ^d |
| <u>Los Angeles Region</u> | | | | | | |
| Sespe Creek near Santa Rosa | 1911-13 | | | | | |
| Arroyo Seco near Pasadena | 1927 to date | 445,750 | 1940-41 | 376,000 | 1950-51 | 3,520 |
| Santa Anita Creek near Sierra Madre | 1910 to date | 11,260 | 1921-22 | 25,400 | 1898-99 | 160 |
| | 1916 to date | 11,480 | 1921-22 | 16,600 | 1898-99 | 210 |
| | | | 1942-43 | | | |
| San Gabriel River near Union | 1894 to date | 239,060 | 1921-22 | 410,000 | 1898-99 | 9,620 |
| <u>Lahontan Region</u> | | | | | | |
| Crows River below Long Valley | 1916 to date | 174,480 | 1906-07 | 292,000 | 1930-31 | 73,000 |
| Rock Creek near Walker's | 1923-27 | | | | | |
| | 1938 to date | 15,020 | 1921-22 | 39,000 | 1950-51 | 1,330 |
| Deep Creek near Hesperia | 1904-22 | | | | | |
| | 1929 to date | 100,000 | 1921-22 | 177,000 ^f | 1950-51 | 4,340 ^f |
| <u>Colorado River Basin Region</u> | | | | | | |
| Colorado River at Lee's Ferry | 1895 to date | 14,220,700 ^e | 1916-17 | 21,860,000 ^{cf} | 1933-34 | 4,577,000 ^{cf} |
| Colorado River at Hoover Dam | 1933 to date | 12,250,500 ^e | 1941-42 | 17,880,000 ^{cf} | 1933-34 | 5,058,000 ^{cf} |
| Colorado River at Yuma | 1878 to date | 3,115,500 ^{ch} | 1908-09 | 26,070,000 ^{cf} | 1955-56 | 894,000 ^{cf} |
| Palm Canyon Creek near Palm Springs | 1930-41 | | | | | |
| | 1947 to date | 7,290 | 1936-37 | 18,980 ^f | 1955-56 | 0.2 ^f |

ESTIMATED NATURAL RUNOFF AT
SELECTED STATIONS IN SOUTHERN CALIFORNIA
FOR THE 1957-58 SEASON
(continued)

In Acre-Feet

| Station | Period : of record : | 1957-58 : | 53-Year mean ^a : | Maximum ^b | | Minimum ^b | |
|------------------------------|-------------------------|--------------|-----------------------------------|----------------------|------------|----------------------|------------|
| | | | | Season : | Quantity : | Season : | Quantity : |
| <u>Santa Ana Region</u> | | | | | | | |
| Cucamonga Creek near Upland | 1928 to date | 12,370 | 6,190 | 1921-22 | 20,900 | 1898-99 | 930 |
| Santa Ana River near Mentone | 1896 to date | 87,880 | 70,600 | 1915-16 | 280,000 | 1950-51 | 13,090 |
| <u>San Diego Region</u> | | | | | | | |
| Murrieta Creek at Temecula | 1930 to date | 14,220 | 8,670 | 1915-16 | 60,300 | 1933-34 | 420 |
| Santa Ysabel Creek at | 1912 to 1928 | | | | | | |
| Sutherland Dam ⁱ | 1936 to date | 14,540 | 15,200 | 1915-16 | 95,200 | 1954-55 | 700 |
| Cottonwood Creek at Morena | 1911 to date | 2,680 | 12,400 | 1915-16 | 75,300 | 1955-56 | 130 |
| Dam | | | | | | | |

a. Mean for period 1894-95 through 1946-47, except as noted.

b. Indicated maxima and minima are recorded or estimated values for period 1894-95 to date, except as noted.

c. Measured runoff, unadjusted for upstream development.

d. Years of no flow also included 1895-96, 1897-1900, 1901-02, 1918-19, 1920-21, and 1922-25.

e. Average for period 1920-21 through 1949-50.

f. Indicated maxima and minima are recorded or estimated values for given period of record.

g. Average for period 1936-37 through 1955-56.

h. Includes discharges from Yuma Main Canal Wasteway and California Drainage Canal.

i. Replaces station located near Mesa Grande for which period of record is 1912-13 through 1927-28.

Runoff to the Ocean

As might be suspected, during the 1957-58 season of above-normal precipitation, substantial amounts of water escaped the concerted conservation efforts of agencies of Southern California and flowed into the ocean. As also might be suspected, a large part of this flow to the ocean represented runoff from urban areas near the coast, which flows are not susceptible of capture and storage in surface or underground reservoirs. An additional large part of these flows to the ocean represent high intensity flood flows which, by their nature, are not susceptible of storage and conservation.

An estimate of the total flows to the ocean, based upon stream flow measurements near the coast on the larger streams, was prepared and is shown in Table 10. Table 10 shows that the total 1957-58 seasonal ocean discharge from 18 streams which discharge most of the runoff amounted to 1,164,500 acre-feet. For comparison purposes, the discharges of these streams for the previous season are also presented. The 1957-58 seasonal discharge was over 10 times that of the previous year. It may also be noted that 80 per cent of the 1957-58 discharge was from five streams, the Santa Clara, Los Angeles, Santa Ynez, Ventura and Santa Maria Rivers.

TABLE 10

ESTIMATED DISCHARGE TO THE OCEAN DURING 1956-57 AND
1957-58 FROM SELECTED STREAMS IN SOUTHERN CALIFORNIA

| Stream | Discharge, in acre-feet | |
|-------------------------------|-------------------------|-----------|
| | 1956-57 | 1957-58 |
| <u>Central Coastal Region</u> | | |
| Santa Maria River | 0 | 126,950 |
| Santa Ynez River | 120 | 176,500 |
| <u>Los Angeles Region</u> | | |
| Ventura River | 2,200 | 160,600 |
| Santa Clara River | 5,620 | 279,300 |
| Ballona Creek | 27,440 | 51,450 |
| Dominguez Channel | 11,440 | 30,080 |
| Los Angeles River | 48,710 | 191,100 |
| Los Cerritos Channel | 2,920 | 9,630 |
| San Gabriel River | 900 | 23,750 |
| Coyote Creek | 1,200 | 15,220 |
| <u>Santa Ana Region</u> | | |
| Santa Ana River | 370 | 17,370 |
| Santa Ana Delhi Drain | 950 | 3,400 |
| Peters Canyon Drain | 230 | 3,150 |
| <u>San Diego Region</u> | | |
| Aliso Creek | 0 | 1,380 |
| Trabuco Creek | 120 | 11,990 |
| San Juan Creek | 930 | 27,560 |
| Santa Margarita River | 0 | 32,350 |
| San Luis Rey River | 0 | 2,710 |
| TOTALS | 103,150 | 1,164,490 |

Storage in Surface Reservoirs

Water stored in Southern California reservoirs generally increased during the 1957-58 season, though effects of the prolonged drought which commenced in 1944-45 were still apparent. Storage in selected surface reservoirs in, or supplying water to, Southern California is presented in Table 11 for both October 1, 1958, and October 1, 1957.

WATER IN STORAGE IN SELECTED SURFACE RESERVOIRS
IN, OR SUPPLYING WATER TO, SOUTHERN CALIFORNIA
ON OCTOBER 1, 1957, AND OCTOBER 1, 1958

| Watershed | Reservoir | Capacity, in acre-feet | Water in storage, in acre-feet | Water in storage, in per cent of capacity |
|------------------------------------|-----------------------------|---------------------------|-----------------------------------|---|
| : | : | : | : | : |
| : | : | October : 1, 1957 : | October : 1, 1958 : | October : 1, 1957 : |
| : | : | 1, 1957 : | 1, 1958 : | 1, 1958 : |
| : | : | : | : | : |
| <u>Central Coastal Region</u> | | | | |
| <u>Santa Ynez River</u> | | | | |
| | Gibraltar | 15,600 | 10,600 | 68 |
| | Cachuma | 206,500 | 30,150 | 15 |
| <u>Los Angeles Region</u> | | | | |
| | Lake Piru | 100,000 | 800 | 1 |
| | Bouquet Canyon ^a | 36,500 | 32,460 | 89 |
| | San Gabriel River | 35,170 | 22,150 | 63 |
| <u>Lahontan Region</u> | | | | |
| | Grant Lake ^a | 47,530 | 45,630 | 96 |
| | Long Valley ^a | 183,470 | 162,670 | 89 |
| | (Lake Crowley) | | | |
| | Tinemaha ^a | 16,410 | 8,830 | 54 |
| | Halwee (South) ^a | 58,530 | 25,950 | 44 |
| <u>Colorado River Basin Region</u> | | | | |
| | Lake Mead | 27,207,000 | 21,522,000 | 79 |
| | Lake Mohave | 1,810,000 | 1,429,000 | 79 |
| | Lake Havasu | 688,000 | 617,000 | 90 |
| <u>Santa Ana Region</u> | | | | |
| | Bear Valley | 72,170 | 1,950 | 3 |
| | Lake Hemet | 13,400 | 320 | 2 |
| | Railroad Canyon | 14,700 | 1,260 ^c | 9 |
| | Lake Mathews | 100,000 | 76,090 ^b | 76 |
| | Santiago | 25,000 | 3,780 ^b | 15 |

WATER IN STORAGE IN SELECTED SURFACE RESERVOIRS
IN, OR SUPPLYING WATER TO, SOUTHERN CALIFORNIA
ON OCTOBER 1, 1957, AND OCTOBER 1, 1958
(continued)

| Watershed | Reservoir | Capacity, in acre-feet | Water in storage, in acre-feet | Water in storage, in per cent of capacity |
|-------------------------|-------------------|---------------------------|-----------------------------------|---|
| : | : | : | : | : |
| : | : | October : 1, 1957 : | October : 1, 1958 : | October : 1, 1957 : 1, 1958 |
| : | : | : | : | : |
| : | : | : | : | : |
| <u>San Diego Region</u> | | | | |
| Temecula Creek | Vail | 49,500 | 550 | 6,850 |
| San Luis Rey River | Lake Henshaw | 194,320 | 1,120 | 20,070 |
| Santa Isabella Creek | Sutherland | 29,680 | 1,440 ^c | 6,480 |
| San Dieguito River | Lake Hodges | 33,550 | 3,460 ^c | 7,000 ^c |
| San Vicente Creek | San Vicente Lake | 90,230 | 43,480 ^c | 71,840 |
| Boulder Creek | Cuyamaca | 11,600 | 0 | 0 |
| San Diego River | El Capitan Lake | 112,810 | 2,550 | 43,520 |
| Sweetwater River | Lake Loveland | 25,390 | 1,660 ^c | 370 |
| Cottonwood Creek | Sweetwater (Main) | 27,690 | 4,440 ^c | 10,370 |
| | Morena Lake | 50,210 | 480 | 1,020 |
| Otay River | Barrett Lake | 44,760 | 780 | 930 |
| | Lower Otay Lake | 56,520 | 3,490 | 15,030 |
| | | | 2 | 2 |
| | | | 6 | 27 |

- Component of the Aqueduct System of the City of Los Angeles.
- Includes Colorado River water imported via Colorado River Aqueduct.
- Includes Colorado River water imported via Colorado River Aqueduct and San Diego Aqueduct.

The total amount of water stored in reservoirs in the coastal portion of Southern California on October 1, 1958, was 550,600 acre-feet, or 41 per cent of capacity. One year earlier it was 18 per cent of capacity. At both times, a significant portion of the water was stored in reservoirs, the contents of which are wholly or in part imported Colorado River water. Improvement was particularly noticeable in reservoirs in the Central Coastal Region, which stored 209,300 acre-feet of local water, or about 94 per cent of capacity, on October 1, 1958. One year before, these reservoirs contained 40,700 acre-feet, or 18 per cent of capacity. On the other hand, reservoirs in the San Diego Region recovered only partially, despite the importation of 135,600 acre-feet of Colorado River water. They contained 183,500 acre-feet of local and imported water on October 1, 1958, or 25 per cent of capacity, while one year before, these reservoirs had contained 63,400 acre-feet, or 9 per cent of capacity.

Total storage in four major reservoirs of the Los Angeles Department of Water and Power in the Owens Valley increased from 79 per cent of capacity on October 1, 1957, to 89 per cent of capacity on October 1, 1958. These reservoirs are used primarily for regulation of flow through the Los Angeles Aqueduct.

Storage in Lake Mead on October 1, 1958, was 23,326,000 acre-feet. The increase during the 1957-58 water year was 1,804,000 acre-feet, or eight per cent.

The water surface elevation of the Salton Sea was 234.70 feet below sea level on September 30, 1958, reflecting an increase of 0.05 foot during the year.

Colorado River Diversions

The total diversions of water from the Colorado River by the principal users in California amounted to 4,123,000 acre-feet during the 1957-58 water year. This was eight per cent less than the volume taken during the previous season, as all agencies reduced their diversions. The Imperial Irrigation District diverted 2,727,000 acre-feet of water, or nearly two-thirds of the total. The water diverted by the principal diverters in California for the 1956-57 and 1957-58 water years are presented in Table 12.

TABLE 12

QUANTITIES OF WATER
DIVERTED FROM THE COLORADO RIVER FOR USE IN
CALIFORNIA DURING 1956-57 AND 1957-58

| Agency | : Diversion, in acre-feet : | | Per cent |
|---|-----------------------------|-----------|----------|
| | : 1956-57 | : 1957-58 | |
| The Metropolitan Water District of Southern California | 600,880 | 534,980 | -11 |
| Palo Verde Irrigation District | 374,920 | 342,500 | - 9 |
| Imperial Irrigation District | 2,968,790 | 2,737,100 | - 8 |
| Coachella Valley County Water District | 524,490 | 498,940 | - 5 |
| Yuma Project (Reservation Division) | 21,780 | 9,520 | -56 |
| TOTALS | 4,190,860 | 4,123,040 | - 8 |

Importation to South Coastal Area

Water imported to coastal Southern California through the facilities of The Metropolitan Water District of Southern California and the City of Los Angeles totaled about 870,000 acre-feet during the 1957-58 water year.

Diversions through the Colorado River Aqueduct, as measured at the Hayfield Pumping Plant, totaled about 535,000 acre-feet. This was about 66,000 acre-feet, or 11 per cent less than the diversion of the previous year. Deliveries of Colorado River water to member agencies of The Metropolitan Water District of Southern California totaled about 554,000 acre-feet during the 1957-58 water year, a decrease of about two per cent from the 1956-57 season. The difference between the diversions and the amount delivered to the counties is accounted for by a 38,000 acre-feet decrease in storage in Lake Mathews, between October 1, 1957, and October 1, 1958, and aqueduct and distribution system losses.

The volumes of Colorado River water delivered to each of the coastal counties are listed in Table 13 for both the 1956-57 and 1957-58 seasons.

TABLE 13
COLORADO RIVER WATER
IMPORTED TO COUNTIES IN COASTAL SOUTHERN CALIFORNIA
DURING 1956-57 AND 1957-58

| County | : Seasonal import, in acre-feet : | | : Per cent : change |
|-----------------------|-----------------------------------|--------------|------------------------|
| | : 1956-57 | : 1957-58 | |
| Los Angeles County | 223,450 | 262,050 | +17 |
| San Diego County | 144,400 | 135,600 | - 6 |
| Orange County | 154,250 | 126,800 | -18 |
| Riverside County | 36,150 | 24,250 | -33 |
| San Bernardino County | <u>7,200</u> | <u>4,900</u> | <u>-32</u> |
| TOTALS | 565,450 | 553,600 | - 2 |

The data presented in Table 13 show an increase in the import to Los Angeles County. A portion of this can be attributed to an increase

in the amount of unsoftened Colorado River water which was spread in artificial recharge projects from 27,900 acre-feet in 1956-57 to 83,070 acre-feet in 1957-58. The decrease in Orange County is attributed in part to the reduction in the amount of water imported for ground water replenishment in the Santa Ana River Spreading Grounds from 102,400 acre-feet during the 1956-57 season to about 83,100 acre-feet during the 1957-58 season. Decreases in other counties were apparently the result of better than average precipitation conditions.

A total of 333,600 acre-feet of water, the estimated flow from Fairmont Reservoir, was imported to the Los Angeles area from the Mono and Owens Basins through the aqueduct of the City of Los Angeles Department of Water and Power. The aqueduct was operated at capacity during the entire 1957-58 water year, with the exception of short periods of shutdown for routine maintenance and inspection.

The historical amounts of water imported to coastal Southern California through the Los Angeles and Colorado River Aqueducts from 1916 to 1958 are graphically illustrated on Plate 5.

Sewage Discharge to Saline Waters

Approximately 663,000 acre-feet of sewage was discharged to the Pacific Ocean and tidal waters of Southern California during 1957-58 through facilities operated by 10 agencies. Table 14 shows the approximate amount of sewage discharged by these agencies. Values for 1956-57 are presented for comparison. The totals indicate that the discharge during 1957-58 was eight per cent greater than the discharge during 1956-57. This increase reflects the extension of sewerage facilities into areas previously served by cesspools, a continued expansion of water use and disposal,

and relatively larger storm runoff. It is interesting to note that about 545,600 acre-feet, or about 82 per cent, of the sewage originated in the Los Angeles metropolitan area and was discharged to saline waters by the City of Los Angeles and the County Sanitation Districts of Los Angeles County.

TABLE 14

SEWAGE DISCHARGED TO SALINE WATERS IN 1956-57 AND 1957-58
THROUGH MAJOR DISPOSAL FACILITIES IN SOUTHERN CALIFORNIA

| Station | Discharge, in acre-feet | | Per cent |
|--|-------------------------|--------------|------------|
| | 1956-57 | 1957-58 | change |
| City of Santa Barbara | 5,210 | 5,540 | + 6 |
| City of Ventura | 2,580 | 3,490 | +35 |
| City of Oxnard | 4,040 | 4,000 | - 1 |
| City of Los Angeles | | | |
| Hyperion | 287,000 | 299,400 | + 4 |
| Terminal Island | 6,770 | 6,900 | + 2 |
| County Sanitation Districts of Los Angeles County | 214,600 | 239,300 | +12 |
| County Sanitation Districts of Orange County | 38,200 | 45,300 | +19 |
| City of Oceanside | 1,780 | 2,050 | +15 |
| City of San Diego | 47,600 | 49,900 | + 5 |
| City of Chula Vista | 2,760 | 2,530 | - 8 |
| International Outfall Sewer | <u>4,170</u> | <u>4,960</u> | <u>+19</u> |
| TOTALS | 614,710 | 663,370 | + 8 |

CHAPTER III. GROUND WATER SUPPLY CONDITIONS

The above-normal water crop of 1957-58 improved conditions in most ground water basins in the Southern California District Area. In many areas artificial ground water recharge activities contributed to this improvement, particularly in Coastal Los Angeles and Orange Counties where large quantities of unsoftened Colorado River water were spread and infiltrated in the Montebello and Santa Ana Forebay Areas. This chapter presents a brief discussion of artificial recharge activity and area by area discussions of ground water conditions during the 1957-58 season for the many ground water basins in the Southern California area.

Artificial Recharge Activities

Artificial recharge of ground water basins is practiced widely in Southern California to increase conservation of local runoff, as well as utilize imported water supplies, and thus augment ground water supplies. During the 1957-58 water year, about 530,000 acre-feet of local and imported water was spread in 56 artificial recharge projects, of which 170,000 acre-feet, or 32 per cent, was imported Colorado River water. In certain areas, the results of this activity were reflected in rises of ground water levels.

The recorded and estimated amounts of water spread at various artificial recharge projects in Southern California during the 1957-58 water year are presented in Table 15.

TABLE 15

SUMMARY OF PRINCIPAL ARTIFICIAL GROUND WATER RECHARGE ACTIVITIES
IN SOUTHERN CALIFORNIA DURING THE 1957-58 WATER YEAR

| Ground water basin | Unit code no. | Agency conducting spreading operation ^a | Number of projects operated | Reported amount spread, in acre-feet |
|---|---------------------|---|--------------------------------------|---|
| Ojai Valley | (4- 2.00) | VCFC | 1 | 1,610 |
| Santa Clara River Valley | (4- 4.00) | | | |
| Oxnard Plain Forebay Area | (4- 4.02) | UWCD | 2 | 74,460 |
| Piru Basin | (4- 4.06) | UWCD | 1 | 12,020 |
| Coastal Plain, Los Angeles County | (4-11.00) | | | |
| West Coast Basin | (4-11.02) | LACFCD | 2 | 4,380 ^b |
| Montebello Forebay Area | (4-11.05) | LACFCD | 3 | 118,880 ^c |
| San Fernando Valley | (4-12.00) | | | |
| San Fernando Basin | (4-12.01) | LACFCD | 3 | 29,590 |
| | | LADW&P | 1 | 6,280 |
| Tujunga Basin | (4-12.05) | LACFCD | 1 | 1,030 |
| San Gabriel Valley | (4-13.00) | | | |
| Main San Gabriel Basin | (4-13.01) | LACFCD | 4 | 17,550 |
| | | ESWC | 1 | 7,620 |
| Monk Hill Basin | (4-13.02) | LACFCD | 1 | 2,090 |
| Pasadena Subarea | (4-13.03) | LACFCD | 1 | 1,020 |
| Santa Anita Subarea | (4-13.04) | LACFCD | 1 | 1,580 |
| | | CSMWD | 1 | 4,460 |
| Upper Canyon Basin | (4-13.05) | DMWC | 1 | 12,190 |
| | | SGRSC | 1 | 35,360 |
| Glendora Basin | (4-13.07) | GIC | 1 | 650 |
| | | LACFCD | 1 | 2,380 |
| Upper Santa Ana Valley, Los Angeles County | (4-14.00) | | | |
| Claremont Heights Basin | (4-14.04) | PVPA | 2 | 13,040 |
| | | CPWD | 1 | 3,190 |
| Coastal Plain, Orange County | (8- 1.00) | | | |
| Santa Ana Forebay Area | (8- 1.02) | OCWD | 1 | 80,890 ^d |
| | | SAVIC & OCWD | 1 | 740 |
| | | AUWC | 2 | 4,550 ^e |
| | | OCFCD | 1 | 1,330 |
| Yorba Linda Basin | (8- 1.05) | AUWC | 1 | 1,900 |
| Santa Ana Narrows Basin | (8- 1.06) | AUWC | 1 | 1,910 ^f |

TABLE 15

SUMMARY OF PRINCIPAL ARTIFICIAL GROUND WATER RECHARGE ACTIVITIES
IN SOUTHERN CALIFORNIA DURING THE 1957-58 WATER YEAR
(continued)

| Ground water basin | Unit code no. | Agency conducting spreading ^a operation ^a | Number of projects operated | Reported amount spread, in acre-feet |
|--|---------------------|--|--------------------------------------|---|
| Upper Santa Ana Valley | (8-2.00) | | | |
| Chino Basin | (8-2.01) | SBCFCD | 1 | 820 ^b |
| | | EWCD | 2 | 650 ^g |
| Cucamonga Basin | (8-2.03) | SAWC | 1 | 6,940 ^g |
| | | SBCFCD | 1 | 420 |
| Bunker Hill Basin | (8-2.06) | SBVWCD | 3 | 17,690 |
| Lytle Basin | (8-2.07) | FUWC | 1 | 47,110 |
| Devil Canyon Basin | (8-2.10) | SBCFCD | 1 | 1,210 |
| Beaumont Basin | (8-2.12) | RCFC&WCD | 1 | 60 |
| Temescal Basin | (8-2.17) | RCFC&WCD | 1 | 250 |
| Coldwater Basin | (8-2.19) | TWC | 3 | 7,060 |
| Lee Lake Basin | (8-2.20) | TWC | 3 | 3,430 |
| San Jacinto Valley | (8-5.00) | RCFC&WCD | 1 | 2,590 |
| Total local and imported water reported spread | | | | 528,930 |
| Total imported water reported spread | | | | 170,490 |
| Total local water reported spread | | | | 358,440 |

- a. Abbreviations of agencies conducting spreading operations are presented in alphabetical order: AUWC-Anaheim Union Water Company; CPWD-City of Pomona Water Department; CSMWD-City of Sierra Madre Water Department; DMWC-Duarte Mutual Water Company; ESWC-East Side Water Committee; EWC-Etiwanda Water Company; FUWC-Fontana Union Water Company; GIC-Glendora Irrigation Company; LACFCD-Los Angeles County Flood Control District; LADWP-Los Angeles Department of Water and Power; OCFCD-Orange County Flood Control District; OCWD-Orange County Water District; PVPA-Pomona Valley Protective Association; RCFC&WCD-Riverside County Flood Control and Water Conservation District; SAWC-San Antonio Water Company; SBCFCD-San Bernardino County Flood Control District; SBVWCD-San Bernardino Valley Water Conservation District; SGRSC-San Gabriel River Spreading Corporation; SAVIC-Santa Ana Valley Irrigation Company; TWC-Temescal Water Company; UWCD-United Water Conservation District; VCFCD-Ventura County Flood Control District.
- b. Includes about 4,270 acre-feet of softened Colorado River water. All water injected through wells of experimental fresh water barrier project.
- c. Includes about 83,070 acre-feet of unsoftened Colorado River water of which 16,970 acre-feet is spread in the San Gabriel River channel.
- d. Total quantity is unsoftened Colorado River water.
- e. Includes about 2,230 acre-feet of unsoftened Colorado River water.
- f. Includes about 30 acre-feet of unsoftened Colorado River water.
- g. Incomplete record.

Ground Water Conditions

There was a general improvement in water conditions in ground water basins throughout Southern California between the summer of 1957 and the summer of 1958. Observations indicated either a rise or a decrease in the rate of decline in water level elevations. In spite of this improvement, water level elevations remained below sea level in many coastal basins, and conditions were still favorable to sea-water intrusion.

Discussions of ground water conditions in the various regions and basins of the Southern California area are presented in the following section.

Central Coastal Region No. 3

Measurements of depth to ground water at wells in San Luis Obispo and Santa Barbara Counties indicate that there were rises in ground water level elevations in nearly all basins between the summer of 1957 and the summer of 1958. However, ground water level elevations continued below sea level in the Goleta and Carpinteria Basins of the South Coast Basins of Santa Barbara County. The available ground water levels for the Central Coastal Region are tabulated in Volume II, Appendix B. The estimated average changes in ground water level elevations during the year for selected ground water basins in this region are given in Table 16. The historical fluctuation of water levels at selected wells in Region No. 3 is shown on Plate 12A, and the locations of wells for which these water level fluctuations are shown are delineated on Plate 6.

TABLE 16

ESTIMATED AVERAGE CHANGES IN GROUND WATER LEVEL ELEVATIONS IN
SELECTED GROUND WATER BASINS IN CENTRAL COASTAL REGION NO. 3
DURING 1957-58

| Ground water basin | : : Estimated : | | | Location and observed extremes | |
|--------------------------|-----------------|--------------------|-------------|--------------------------------|----------------------------|
| | : Number of : | : average change : | : wells : | : in ground water : | : of depth to ground water |
| | : considered: | : level during : | : in : | : the year, | : during 1957-58, in feet |
| Name | : Number : | : analysis : | : in feet : | Maximum | : Minimum |
| Salinas Valley | 3- 4.00 | 21 | + 4* | 26S, 12E-26EL, M | 26S, 14E-14EL, M |
| Paso Robles Basin | 3- 4.06 | | | 190.0 | Flowing |
| San Luis Obispo Group | 3- 8.00 | 2 | +18 | 29S, 11E-19PL, M | 29S, 11E-30DL, M |
| Morro Basin | 3- 8.01 | | | 49.8 | 24.2 |
| Los Osos Basin | 3- 8.03 | 2 | + 7 1/2 | 30S, 11E- 7KL, M | 30S, 11E-21EL, M |
| | | | | 44.1 | 19.5 |
| San Luis Obispo Basin | 3- 8.04 | 4 | + 2 1/2* | 31S, 13E-19HL, M | 31S, 12E- 4KL, M |
| | | | | 21.0 | 3.6 |
| Arroyo Grande Group | 3-11.00 | 15 | + 5 1/2* | 32S, 13E-29ML, M | 12N, 35E-30.1, S |
| Arroyo Grande Basin | 3-11.01 | | | 91.3 | 0.4 |
| Santa Maria River Valley | 3-12.00 | 15 | + 6 | 11N, 34W-19CL, S | 11N, 35W-20FL, S |
| | | | | 255.8 | 13.1 |
| Cuyama River Valley | 3-13.00 | 7 | - 1/2 | 9N, 26W- 4EL, S | 10N, 26W-22EL, S |
| | | | | 292.8 | 20.1 |
| San Antonio Creek Valley | 3-14.00 | 5 | + 7 | 8N, 32E-35EL, S | 8N, 32W-30W2, S |
| | | | | 159.0 | 8.7 |

ESTIMATED AVERAGE CHANGES IN GROUND WATER LEVEL ELEVATIONS IN
 SELECTED GROUND WATER BASINS IN CENTRAL COASTAL REGION NO. 3
 DURING 1957-58
 (continued)

| Ground water basin | : : Estimated : | | | Location and observed extremes | |
|---|-----------------|-------------------|---------|--------------------------------|-------------------------|
| | : Number of : | average change : | | of depth to ground water | |
| | : wells : | in ground water : | | during 1957-58, in feet | |
| | : considered: | level during : | | | |
| | : in : | the year, : | | | |
| | : analysis : | in feet : | | Maximum | Minimum |
| Name | : Number : | | | | |
| Santa Ynez River Valley Lompoc Subarea | 3-15.00 | | | | |
| | 3-15.01 | 65 | + 4 | 7N/34W-12E1, S 307.5 | 7N/35W-27C3, S 1.9 |
| | 3-15.02 | 16 | + 2 1/2 | 7N/33W-23R2, S 142.2 | 6N/33W-11L2, S 1.2 |
| | 3-15.03 | 13 | + 3 | 6N/31W- 6D1, S 108.8 | 6N/32W-12R2, S 2.8 |
| | 3-15.04 | 16 | + 7 | 7N/30W-20N2, S 252.5 | 7N/29W-32M1, S 1.0 |
| Headwater Subarea | 3-15.05 | 8 | + 6 1/2 | 6N/30W-23K1, S 41.5 | 6N/30W-24E1, S 0.8 |
| South Coast Basins, Santa Barbara County | | | | | |
| | 3-16.00 | | | | |
| | 3-16.01 | 14 | + 6 1/2 | 4N/27W- 6Q9, S 246.3 | 4N/28W-17R5, S 1.3 |
| Carpinteria Basin | 3-16.04 | 11 | +11 | 4N/25W-26A1, S 324.3 | 4N/25W-30D1, S 1.5 |
| | | | | | |
| Carrizo Plain | 3-19.00 | 3 | 0* | 29S/18E-28K1, M 45.4 | 30S/18E- 2M1, M 25.3 |

*Average change in ground water level elevations for period fall, 1957, to fall, 1958.

Ground water levels in the Paso Robles Basin of the Upper Salinas Valley rose an average of four feet between the fall of 1957 and the fall of 1958. Depth to water ranged from flowing, just west of Shandon to 190 feet in the vicinity of the City of Paso Robles.

In the San Luis Obispo group, ground water levels rose in all basins between the fall of 1957 and the fall of 1958. Particular recovery was noted in Morro Basin, where an average increase of eighteen feet is indicated.

Observed ground water level elevations in the Arroyo Grande Basin indicated an average rise of between five and six feet between the fall of 1957 and the fall of 1958. In this basin, the static ground water level was observed to be about 30 feet below sea level about one mile from the ocean, just north of Oceano.

In the Santa Maria River Valley, water levels rose an average of about six feet between the summer of 1957 and the summer of 1958. Observed depths to ground water ranged from a minimum of 13 feet at a well located about 4 miles north of Guadalupe, to a maximum of over 250 feet in the vicinity of Nipomo.

A general rise in ground water level elevations occurred throughout all basins of the Santa Ynez River Valley during the period of summer, 1957, to summer, 1958, with greater changes noted in the upstream Headwater and Santa Ynez Subareas. Maximum observed depth to ground water in the Santa Ynez River Valley was over 300 feet at a well about five miles northeast of the City of Lompoc.

Ground water levels in the South Coast Basins of Santa Barbara County generally showed substantial rise between the summer of 1957 and the summer of 1958. The maximum rise was evidenced in the Carpinteria Basin, where the average increase was about 11 feet. However, static water levels

in many of the wells in the Goleta and Carpinteria Basins continued to be below sea level in the summer of 1958, and there was a continuation of conditions which permit sea-water intrusion. Minimum water level elevations observed during the year were 108 feet below sea level in the Goleta Basin and 43 feet below sea level in the Carpinteria Basin.

TABLE 17

ESTIMATED AVERAGE CHANGES IN GROUND WATER LEVEL ELEVATIONS IN
SELECTED GROUND WATER BASINS IN LOS ANGELES REGION NO. 4
DURING 1957-58

| Ground water basin | : Estimated : | | | Location and observed extremes | |
|----------------------------|---------------|--------------------|----------------------------|--------------------------------|--------------------------|
| | : Number of : | : average change: | : of depth to ground water | : during 1957-58, in feet | |
| | : wells : | : in ground water: | : level during : | | |
| | : in : | : the year, | : in feet : | : Maximum : | : Minimum |
| Name | : Number : | : analysis : | : in feet : | | |
| Upper Ojai Valley | 4- 1.00 | 3 | + 8 1/2 | 4N/22W-12FL,S 149.4 | 4N/22W-10K2,S 14.3 |
| Ojai Valley | 4- 2.00 | 70 | +69 1/2 | 4N/22W- 4LL,S 295.2 | 4N/22W- 6ML,S Flowing |
| Ventura River Valley | 4- 3.00 | | | | |
| Upper Ventura River Basin | 4- 3.02 | 71 | +14 | 4N/23W-21C5,S 176.0 | 4N/23W-32BL,S 0.4 |
| Santa Clara River Valley | 4- 4.00 | | | | |
| Oxnard Plain Pressure Area | 4- 4.01 | 70 | +10 | 1N/21W- 4PL,S 128.6 | 1N/22W-34J2,S 1.5 |
| Oxnard Plain Forebay Area | 4- 4.02 | 19 | +44 1/2 | 2N/22W-13A1,S 125.7 | 2N/22W-12J1,S 7.5 |
| Mound Pressure Area | 4- 4.03 | 16 | + 8 | 2N/22W- 9K3,S 237.9 | 2N/23W-11ML,S 7.1 |
| Santa Paula Basin | 4- 4.04 | 44 | + 7 | 2N/22W- 3M2,S 212.9 | 2N/22W- 1E2,S Flowing |
| Fillmore Basin | 4- 4.05 | 40 | +13 1/2 | 4N/20W-31HL,S 331.1 | 3N/20W- 4W2,S 0.0 |
| Piru Basin | 4- 4.06 | 27 | +38 1/2 | 4N/18W-20ML,S 220.9 | 3N/20W- 8GL,S 5.9 |
| Eastern Basin | 4- 4.07 | 13 | +20 1/2 | 5N/14W-13CL,S 181.7 | 5N/14W-27JL,S 6.4 |
| Pleasant Valley | 4- 6.00 | 23 | 0 | 2N/20W-21LL,S 358.9 | 1N/21W-27FL,S 30.5 |

ESTIMATED AVERAGE CHANGES IN GROUND WATER LEVEL ELEVATIONS IN
SELECTED GROUND WATER BASINS IN LOS ANGELES REGION NO. 4
DURING 1957-58
(continued)

| Ground water basin | : Number of : Estimated : | | : Location and observed extremes | | |
|--|------------------------------|--------------|----------------------------------|-------------------------|------------------------|
| | : wells : in ground water: | | : of depth to ground water | | |
| | : considered: level during : | | : during 1957-58, in feet | | |
| | : in : the year, : | | : : | | |
| Name | : Number : | : analysis : | : in feet : | : Maximum : Minimum | |
| Arroyo Santa Rosa Valley | 4- 7.00 | 9 | +13 1/2 | 2N/19W-21H1, S 256.5 | 2N/19W-19L1, S 47.0 |
| Las Posas Valley | 4- 8.00 | | | | |
| | 4- 8.01 | 19 | 0 | 3N/21W-36P1, S 336.8 | 3N/21W-21B2, S 13.9 |
| East Las Posas Basin | 4- 8.02 | 72 | + 3 1/2 | 3N/20W-31K1, S 544.0 | 2N/19W- 3A4, S 30.4 |
| Simi Valley | 4- 9.00 | 59 | + 7 | 2N/18W- 1F1, S 296.6 | 2N/17W- 9M2, S 6.8 |
| Conejo Valley | 4-10.00 | 35 | + 7 1/2 | 1N/19W-14K4, S 206.4 | 1N/19W-18C4, S 2.0 |
| Coastal Plain, Los Angeles County | 4-11.00 | | | | |
| | 4-11.01 | 10 | + 1/2 | 1S/16W-18L2, S 203.0 | 2S/15W-23K1, S 5.6 |
| West Coast Basin | 4-11.02 | 103 | - 1 1/2 | 2S/14W-27P2, S 256.0 | 5S/13W- 3P5, S 0.0 |
| Central Coastal Plain Pressure Area | 4-11.03 | 35 | + 3 1/2 | 3S/14W- 1F3, S 261.9 | 5S/12W-11D1, S 3.2 |
| | 4-11.04 | 44 | + 1 | 2N/13W- 2M2, S 425.8 | 1S/13W-27Q2, S 52.4 |
| Montebello Forebay Area | 4-11.05 | 104 | +17 1/2 | 2S/12W-16H1, S 180.1 | 2S/11W- 6M1, S 3.7 |

ESTIMATED AVERAGE CHANGES IN GROUND WATER LEVEL ELEVATIONS IN
SELECTED GROUND WATER BASINS IN LOS ANGELES REGION NO. 4
DURING 1957-58
(continued)

| Ground water basin | : Number of : Estimated : | | : average change: Location and observed extremes | | |
|--|---|--------------------|--|-------------------------|---------------------------|
| | : wells : in ground water: of depth to ground water | | : considered: level during : during 1957-58, in feet | | |
| Name | | : in : the year, : | | : Maximum : Minimum | |
| : Number | | : in feet | | : Maximum : Minimum | |
| Coastal Plain, Los Angeles County (continued) | | | | | |
| Los Angeles Narrows Basin | 4-11.07 | 18 | + 2 | 1S/13W- 4P1, S 61.9 | 1S/13W-35F1, S 6.4 |
| La Habra Basin | 4-11.08 | 13 | + 4 | 2S/11W-35R1, S 234.0 | 3S/11W- 2M1, S 3.0 |
| San Fernando Valley | | | | | |
| San Fernando Basin | 4-12.00 4-12.01 | 40 | - 1 | 2N/15W-24K1, S 304.0 | 2N/16W-34G1, S Flowing |
| Sylmar Basin | 4-12.03 | 3 | + 1/2 | 3N/15W-34A1, S 146.3 | 2N/15W- 4B6, S 14.5 |
| Pacoima Basin | 4-12.04 | 3 | + 9 | 3N/15W-26G1, S 247.2 | 3N/15W-36E1, S 6.4 |
| Tujunga Basin | 4-12.05 | 7 | + 3 | 2N/15W- 1G1, S 212.0 | 2N/14W-14C4, S 5.5 |
| Verdugo Basin | 4-12.07 | 10 | + 8 1/2 | 2N/13W-27Q1, S 253.2 | 2N/13W-10Q1, S 26.9 |
| San Gabriel Valley | | | | | |
| Main San Gabriel Basin | 4-13.00 4-13.01 | 44 | +11 | 1S/12W-10E1, S 358.0 | 1S/11W- 1C1, S Flowing |
| Monk Hill Basin | 4-13.02 | 8 | +20 1/2 | 1N/12W- 5P1, S 306.0 | 1N/12W- 5N1, S 88.7 |
| Pasadena Subarea | 4-13.03 | 59 | + 6 1/2 | 1N/12W-23G1, S 339.6 | 1N/11W-29K1, S Flowing |
| Santa Anita Subarea | 4-13.04 | 15 | +35 1/2 | 1N/11W-21C3, S 247.9 | 1N/11W-22F1, S 11.4 |
| Upper Canyon Basin | 4-13.05 | 16 | +31 1/2 | 1N/10W-27K2, S | 1N/10W-23A2, S |

ESTIMATED AVERAGE CHANGES IN GROUND WATER LEVEL ELEVATIONS IN
SELECTED GROUND WATER BASINS IN LOS ANGELES REGION NO. 4
DURING 1957-58
(continued)

| Ground water basin | Name | Number | : analysis : | : in : | the year, | : in foot : | Estimated : : Number of : average change : : wells : in ground water : : considered: level during : : in : the year, | Location and observed extremes of depth to ground water during 1957-58, in feet | Maximum : Minimum |
|--|-----------------|---------|--------------|---------|-----------|-------------|--|---|--------------------------|
| | | | | | | | | | |
| San Gabriel Valley (continued) Lower Canyon Basin | | 4-13.06 | 6 | +10 | | | | 1N/10W-29J1, S 132.4 | 1N/10W-35B11, S 1.4 |
| | Glendora Basin | 4-13.07 | 16 | +15 | | | | 1N/ 9W-29E1, S 396.6 | 2S/10W-15F 4, S 9.1 |
| | Way Hill Basin | 4-13.08 | 4 | + 9 | | | | 1S/ 9W- 8C2, S 204.0 | 1S/ 9W- 6H 1, S 53.8 |
| | San Dimas Basin | 4-13.09 | 10 | + 5 | | | | 1N/ 9W-36M1, S 297.6 | 1N/ 9W-35L 2, S 8.1 |
| | Foothill Basin | 4-13.10 | 3 | +17 1/2 | | | | 1N/ 9W-36E2, S 227.4 | 1N/ 9W-25K 1, S 17.3 |
| | Spadra Basin | 4-13.11 | 3 | + 1/2 | | | | 1S/ 9W-25B1, S 197.0 | 2S/ 9W- 3P 3, S 27.9 |
| | Puente Basin | 4-13.12 | 25 | + 5 1/2 | | | | 2S/10W-14M1, S 75.5 | 1S/ 9W-32C 3, S 3.6 |
| Upper Santa Ana Valley, Los Angeles County Chino Basin | | 4-14.00 | | | | | | | |
| | | 4-14.01 | 2 | - 1 | | | | 1S/ 8W-28G2, S 284.6 | 1S/ 8W-31J 1, S 115.8 |
| | Pomona Basin | 4-14.02 | 9 | - 1 | | | | 1S/ 8W- 7G2, S 400.0 | 1S/ 9W-11J 1, S 0.0 |
| | Live Oak Basin | 4-14.03 | 4 | +13 | | | | 1S/ 8W- 7D1, S 240.9 | 1N/ 8W-32P 2, S 51.4 |

ESTIMATED AVERAGE CHANGES IN GROUND WATER LEVEL ELEVATIONS IN
SELECTED GROUND WATER BASINS IN LOS ANGELES REGION NO. 4
DURING 1957-58
(continued)

| Ground water basin | : Number : | : Estimated : | : Number of : average change: | : wells : in ground water: | : considered: level during : | : in : the year, : | Location and observed extremes of depth to ground water during 1957-58, in feet | |
|--|--------------------|---------------|-------------------------------|----------------------------|------------------------------|-----------------------|---|---------|
| | | | | | | | Maximum | Minimum |
| Upper Santa Ana Valley, Los Angeles County (continued) Claremont Heights | 4-14.04 | 7 | +16 1/2* | | 1N/ 8N-33Q2,S 400.0 | 1N/ 3N-26D1,S 5.7 | | |
| Sierra Rejada Valley | 4-15.00 | 4 | + 2 1/2 | | 2N/19N-15N2,S 223.5 | 2N/19N-14N1,S 33.6 | | |
| Malibu Coastal Group Hidden Valley Basin | 4-16.00 4-16.01 | 20 | +47* | | 1N/20N-25D1,S 207.3 | 1N/19N-29D3,S 2.2 | | |
| Malibu Creek Basin | 4-16.16 | 6 | + 1/2* | | 1S/17N-30N1,S 85.2 | 1S/17N-32D5,S 10.9 | | |

*Average change in ground water level elevations for period spring, 1957, to spring, 1958.

Measurements of depths to ground water indicate that ground water levels rose in nearly every basin in this region during the period between the summer of 1957 and the summer of 1958, and in some basins the recovery was very substantial, notably in Ojai, where measurements of 70 wells indicated an average increase of nearly 70 feet. In many of these basins, this rise can be attributed in part to spreading conducted in artificial recharge projects. On the other hand, levels in nearly all coastal ground water basins remained below sea level, so conditions permitting sea-water intrusion continued to prevail.

The estimated average change in ground water level elevations for selected ground water basins in the Los Angeles Region is presented in Table 17, and a complete tabulation of water levels for this region for the period July, 1957, through June, 1958, is presented in Volume II, Appendix C. Fluctuations of water levels at selected wells are shown on Plate 12, and the locations of the wells themselves are delineated on Plate 7.

In Ventura County, water levels indicate that rises in water surface elevations occurred in nearly all basins between the summer of 1957 and the summer of 1958. Particularly large increases were noted in Ojai Valley, where the average rise was about 70 feet, and in Piru Basin and Oxnard Plain Forebay Area, where the average increases were about 38 feet and 45 feet, respectively. Artificial recharge activities played important roles in the recovery in both Ojai Valley, where about 1,600 acre-feet of water was spread and the Oxnard Plain Forebay Area, where 74,000 acre-feet of water was spread. Maximum observed depths to water were generally on the order of 125 to 350 feet, with the exception of East Las Posas Basin,

where a maximum observed depth of 544 feet was recorded.

Water levels in a portion of the Oxnard Plain Forebay Area and piezometric levels throughout most of the Oxnard Plain Pressure Area continued to be below sea level. The resulting landward hydraulic gradient maintains conditions which have permitted the intrusion of sea water into the area. Ground water contours presented on Plate 13 indicate that the trough in the Oxnard Plain Pressure Area was located parallel to, and about one mile east of, U. S. Highway 101 Alternate.

Measurements of depth to ground water indicated changes averaging less than four feet in water levels in ground water basins in the Coastal Plain of Los Angeles County between the summer of 1957 and the summer of 1958, with the exception of the Montebello Forebay Area, where a large rise in water levels is indicated. A large portion of the piezometric surface underlying the Los Angeles Coastal Plain continued to remain far below sea level. No significant change was observed in the water level elevations of the trough in the West Coast Basin. This trough is currently located about four miles inland from the coast and extends generally in a southeasterly direction from the southerly end of the Charnock fault through well 4S/13W-7H1,S, the locations of which are shown on Plate 15. The piezometric level of the trough in June, 1953, was generally more than 70 to 80 feet below sea level.

In the Central Coastal Plain Pressure Area, an average rise of about three feet was observed in the piezometric levels between the summer of 1957 and the summer of 1953. However, the pressure levels remained below sea level throughout most of the basin, with levels observed to be as much as 110 feet below sea level in the vicinity of Lakewood.

The average rise of water levels in the Montebello Forebay Area, based on measurements of 104 wells in that area, was about 17 feet, due in large

measure to the approximately 118,900 acre-feet of local and imported water spread in artificial recharge projects adjacent to the Rio Hondo and the San Gabriel River. This rise is illustrated by the hydrographs for wells 2S/11W-18M2,S, and 2S/11W-18K3,S, on Plate 12A. In contrast, notice the hydrograph for well 2S/13W-10A1,S, in the Los Angeles Forebay Area, where there was no artificial recharge activity. Water level elevations for this well show a steady decline totaling about 130 feet from the spring of 1945 to the spring of 1958.

Observations of ground water levels in the San Fernando Basin indicate a decline averaging about one foot between the summer of 1957 and the summer of 1958. However, the smaller ground water basins in the northern portion of the San Fernando Valley exhibited rises in average water levels ranging from about three to nine feet. The depth to water varied from flowing in the western portion of the valley to over 300 feet just south of Hansen Dam.

In the San Gabriel Valley, average water levels in ground water basins rose from five feet to over 35 feet. The largest increases were observed in the smaller basins adjacent to the mountains, such as Upper Canyon Basin, Lower Canyon Basin, and the Santa Anita Subarea. This general increase was due, in part, to the spreading of some 84,900 acre-feet of local water in artificial recharge projects in the valley. Of this amount, 47,600 acre-feet was spread in the Upper Canyon Basin. Depths to water in the San Gabriel Valley ranged from zero, or rising water, at Whittier Narrows and near the Raymond fault, to nearly 400 feet near the City of Glendora.

In general, average changes in ground water levels were minor, amounting to less than two feet, in most of the ground water basins in the Lahontan Region during the period encompassed by this report. In many ground water basins, the number of wells measured is small, and the averages may not truly reflect ground water conditions. However, in some desert areas where substantial development has occurred, such as the Harper, Antelope, and Mojave River Valleys, sufficient observations were made in the spring of 1957 and 1958 to indicate the trend in water level elevations during this period. In the Lancaster Basin of the Antelope Valley, for example, probably the most thoroughly developed part of the Lahontan area, measurements of 61 wells indicated a decline of about 2 feet between the spring of 1957 and the spring of 1958. During the same period, water levels rose over a foot in the Upper Mojave River Valley and about a foot and one-half in the Middle Mojave River Valley, but declined about a foot in the Lower Mojave River Valley. Average water levels in Harper Valley increased about a foot between the spring of 1957 and the spring of 1958. It should be noted, however, that the spring measurements in the Lahontan area were made in March, before the end of the wet season, so the full effects of the wet year are not reflected.

All available water level data for the period between the summer of 1957 and the summer of 1958 for the Lahontan Region are tabulated in Volume III, Appendix E, and a summary of these data is presented in Table 18. Historical changes in water level elevations at selected wells in basins in the Lahontan Region are given on Plate 12B, and the locations of the wells for which these water level fluctuations are shown are presented on Plate 8.

TABLE 18

ESTIMATED AVERAGE CHANGES IN GROUND WATER LEVEL ELEVATIONS IN
SELECTED GROUND WATER BASINS IN LAHCATAN REGION NO. 6
DURING 1957-58

| Ground water basin | : : : | | | : : : | | | : : : | | |
|---------------------------|-------------|--------------|----------------|----------------|----------------|----------------|--------------------------------|--------------------------|-------------------------|
| | Number of | Estimated | average change | Number of | Estimated | average change | Location and observed extremes | of depth to ground water | during 1957-58, in feet |
| | considered: | level during | | considered: | level during | | | | |
| | in | the year, | | in | the year, | | | | |
| Name | Number | analysis | in feet | Number | analysis | in feet | Maximum | : | Minimum |
| Pahrump Valley | 6-28.00 | 2 | - 1/2* | 21N/10E-4L,S | 21N/10E-33AL,S | 99.0 | 161.8 | | |
| Mesquite Valley | 6-29.00 | 5 | - 1/2* | 20N/12E-19FL,S | 19N/12E-11BL,S | 30.6 | 132.8 | | |
| Ivanpah Valley | 6-30.00 | 8 | 1* | 16N/13E-14JL,S | 16N/14E-31EL,S | 12.8 | 288.7 | | |
| Soda Lake Valley | 6-33.00 | 5 | 0* | 14N/ 9E-30G2,S | 12N/ 8E-27X2,S | 18.8 | 77.8 | | |
| Cronise Valley | 6-35.00 | 2 | - 1/2* | 12N/ 7E-30JL,S | 12N/ 7E-18R2,S | 14.5 | 46.9 | | |
| Coyote Lake Valley | 6-37.00 | 6 | 0* | 12N/ 2E-31AL,S | 11N/ 2E- 8KL,S | Flowing | 55.9 | | |
| Troy Valley | 6-39.00 | 5 | 0* | 8N/ 4E-12NL,S | 8N/ 4E- 7EL,S | 2.4 | 32.3 | | |
| Lower Mojave River Valley | 6-40.00 | 28 | -1 | 9N/ 1E- 9DL,S | 9N/ 3E-19EL,S | 8.2 | 117.0 | | |

ESTIMATED AVERAGE CHANGES IN GROUND WATER LEVEL ELEVATIONS IN
 SELECTED GROUND WATER BASINS IN LAHONTAN REGION NO. 6
 DURING 1957-58
 (continued)

| Ground water basin | Name | : Number : | : analysis : | : in feet : | : Estimated : | : average change : | : wells : | : in ground water : | : considered : | : level during : | : the year, : | Location and observed extremes | |
|----------------------------|------|------------|--------------|-------------|---------------|--------------------|-----------|---------------------|----------------|------------------|---------------|--------------------------------|------------------------|
| | | | | | | | | | | | | Maximum | Minimum |
| Middle Mojave River Valley | | 6-41.00 | 13 | | +1 1/2* | | | | | | | 8N/ 6W-14Q1, S 203.7 | 8N/ 4W-31R1, S 7.2 |
| Upper Mojave River Valley | | 6-42.00 | 45 | | +1* | | | | | | | 3N/ 5W-14D1, S 251.4 | 3N/ 3W- 6E2, S 4.8 |
| El Mirage Valley | | 6-43.00 | 5 | | 0* | | | | | | | 5N/ 7W- 9H1, S 283.3 | 6N/ 7W-12N1, S 20.1 |
| Antelope Valley | | 6-44.00 | | | | | | | | | | | |
| Neenach Basin | | 6-44.01 | 5 | | +6* | | | | | | | 8N/15W-33G1, S 267.0 | 8N/15W-36M1, S 57.5 |
| Willow Springs Basin | | 6-44.02 | 5 | | -2* | | | | | | | 11N/13W-29M1, S 333.0 | 9N/13W- 7Q1, S 15.0 |
| Lancaster Basin | | 6-44.05 | 61 | | -1 1/2* | | | | | | | 6N/13W-12J1, S 324.7 | 7N/13W-11D1, S 4.7 |
| Buttes Basin | | 6-44.06 | 2 | | -1 1/2 | | | | | | | 6N/10W-20N1, S 221.7 | 5N/12W-12A2, S 10.5 |

ESTIMATED AVERAGE CHANGES IN GROUND WATER LEVEL ELEVATIONS IN
SELECTED GROUND WATER BASINS IN LAHONTAN REGION NO. 6
DURING 1957-58
(continued)

| Ground water basin | Number | Analysis | in feet | Estimated average change in ground water level during the year, | Number of wells considered in analysis | Location and observed extremes of depth to ground water during 1957-58, in feet |
|-----------------------------|---------|----------|---------|---|--|---|
| | | | | | | Maximum : Minimum |
| Antelope Valley (continued) | | | | | | |
| Rock Creek Basin | 6-44.07 | 9 | +5 | | 5N/ 9W-34DL, S 425.4 | 4N/ 9W- 6GL, S 4.8 |
| North Muroc Basin | 6-44.08 | 4 | - 1/2* | | 11N 9W-17DL, S 130.7 | 10N/ 9W-24A2, S 72.3 |
| Fremont Valley | 6-46.00 | 7 | -1* | | 32S/37E-11NL, M 279.1 | 30S/38E-32EL, M 37.2 |
| Harper Valley | 6-47.00 | 18 | +1* | | 10N/ 5W- 3JL, S 224.3 | 11N/ 3W-32RL, S 16.8 |
| Superior Valley | 6-49.00 | 3 | 0* | | 31S/45E- 10L, M 117.5 | 31S/46E-12PL, M 84.7 |
| Cuddleback Valley | 6-50.00 | 4 | + 1/2* | | 30S/42E-24LL, M 147.5 | 31S/42E- 5RL, M 51.8 |

*Average change in ground water level elevations for period spring, 1957, to spring, 1958.

Colorado River Basin Region No. 7

Observations of depths to ground water in this region indicated only minor changes, amounting to less than two feet, in the average water levels during the period encompassed by this report. Here, as in other desert areas, the number of wells measured in many ground water basins is small and the observations may not truly reflect actual ground water conditions.

Average declines of up to one and one-half feet were observed in ground water basins for which only spring water level measurements were available. For example, between spring of 1957 and spring of 1958, the water levels declined an average of about one and one-half feet in Borrego and Morongo Valleys, while no average change apparently occurred in the Twentynine Palms Valley. On the other hand, rises averaging about one foot and one and one-half feet occurred in the Bristol and Chuckawalla Valleys, where depth to ground water observations for the summers of 1957 and 1958 are available. Such facts emphasize the effect of the late spring rains on ground water replenishment, which is not reflected in observations made in mid-March. The largest range in observed depth to ground water in the region was found in the Coachella Valley, where a flowing well was observed about three miles southwest of Mecca, and a depth to water of 532 feet was observed in a well about five miles northeast of Palm Springs, adjacent to the San Jacinto Mountains.

All available water level data for the period between the summer of 1957 and the summer of 1958 for the Colorado River Basin Region are tabulated in Volume III, Appendix F, and summarized by basin in Table 19. The historic change in water level for well 10S/6E-21A1,S, located in the Borrego Valley, is represented by the hydrograph on Plate 12B, and the location of this well is shown on Plate 9.

TABLE 19

ESTIMATED AVERAGE CHANGES IN GROUND WATER LEVEL ELEVATIONS IN
SELECTED GROUND WATER BASINS IN COLORADO RIVER BASIN REGION NO. 7
DURING 1957-58

| Ground water basin | : : : | | | : : : | | | : : : | | |
|--------------------------|-------|---------|----------|---------|-----------|----------------|-----------------|-----------------|--------------------------------|
| | Name | Number | analysis | in feet | Estimated | average change | Number of wells | in ground water | Location and observed extremes |
| | | | | | | | | | of depth to ground water |
| | | | | | | | | | during 1957-58, in feet |
| | | | | | | | | | |
| | | | | | | | | | |
| Fenner Valley | | 7- 2.00 | 3 | 0 | | | 7N/15E-35RL,S | | 6N/16E- 6KL,S |
| | | | | | | | 336.1 | | 259.9 |
| Chuckawalla Valley | | 7- 5.00 | 4 | +1 1/2 | | | 5S/16E- 6KL,S | | 5S/17E-20FL,S |
| | | | | | | | 84.9 | | 41.2 |
| Bristol Valley | | 7- 8.00 | 4 | +1 | | | 5N/14E-15LL,S | | 5N/12E-11XL,S |
| | | | | | | | 209.0 | | 54.8 |
| Dale Valley | | 7- 9.00 | 8 | - 1/2* | | | 1N/10E-22JL,S | | 1N/12E-20CL,S |
| | | | | | | | 299.6 | | 10.1 |
| Twenty-nine Palms Valley | | 7-10.00 | 44 | 0* | | | 1N/ 8E- 9LL,S | | 2N/ 9E-30A2,S |
| | | | | | | | 316.8 | | 0.3 |
| Copper Mountain Valley | | 7-11.00 | 12 | - 1/2* | | | 1N/ 7E-30PL,S | | 1N- 7E-26NL,S |
| | | | | | | | 368.5 | | 169.1 |
| Warren Valley | | 7-12.00 | 6 | -1 1/2* | | | 1N/ 5E-34KL,S | | 1S/ 5E- 4R2,S |
| | | | | | | | 273.4 | | 53.4 |
| Deadman Valley | | 7-13.00 | 2 | - 1/2* | | | 1N/ 6E- 4OL,S | | 1N/ 6E- 9OL,S |
| | | | | | | | 458.3 | | 398.6 |

ESTIMATED AVERAGE CHANGES IN GROUND WATER LEVEL ELEVATIONS IN
SELECTED GROUND WATER BASINS IN COLORADO RIVER BASIN REGION NO. 7
DURING 1957-58
(continued)

| Ground water basin | : Estimated : | | | : Location and observed extremes : | |
|------------------------------|---------------|--------------------|------------------------|------------------------------------|-----------------------------|
| | : Number of : | : average change : | : wells : | : of depth to ground water : | : during 1957-58, in feet : |
| : considered: level during : | | | | | |
| : in : the year, : | | | | | |
| : analysis : in feet : | | | | | |
| Name | : Number : | : in feet : | Maximum | : Minimum | |
| Johnson Valley | 7-18.00 | 2 | 4N/ 3E-24Q1,S 54.8 | 4N/ 4E-19C1,S 44.3 | |
| Lucerne Valley | 7-19.00 | 18 | 5N/ 1E-10H2,S 200.7 | 4N/ 1W-14B1,S Flowing | |
| Morongo Valley | 7-20.00 | 7 | 1S/ 4E-14N1,S 182.9 | 1S/ 4E-33C1,S 3.8 | |
| Coachella Valley | 7-21.00 | 27 | 3S/ 4E-30C1,S 532.2 | 2S/ 1E-17L1,S Flowing | |
| Borrego Valley | 7-24.00 | 7 | 1CS/ 6E-8B1,S 257.9 | 11S/ 6E-11M1,S 18.1 | |

*Average change in ground water level elevations for period spring, 1957, to spring, 1958.

Water levels in ground water basins in the Santa Ana Region generally rose between the summer of 1957 and the summer of 1958, in some cases as much as forty or more feet. This rise can be attributed to the spreading of local and imported water in artificial recharge projects, as well as to natural percolation of runoff from the year's heavy precipitation. The available water level measurements for the Santa Ana Region for 1957-58 are tabulated in Volume III, Appendix G, and some pertinent statistics based on these data are presented in Table 20. Hydrographs of wells to indicate long-term water level fluctuations in the region are delineated on Plate 12B and the locations of these wells are presented on Plate 10.

TABLE 20

ESTIMATED AVERAGE CHANGES IN GROUND WATER LEVEL ELEVATIONS IN
SELECTED GROUND WATER BASINS IN SANTA ANA REGION NO. 8
DURING 1957-58

| Ground water basin | : : : | | | : : : | | | : : : | | | : : : | | |
|----------------------------------|-------|----------|------------|-------|----------------|------------------|-------------|-------------------|----------------------------|----------------------------------|----------------------------|-----------|
| | Name | : Number | : analysis | : in | : level during | : average change | : Estimated | : in ground water | : of depth to ground water | : Location and observed extremes | : Maximum | : Minimum |
| Coastal Plain, Orange County | | 8-1.00 | | | | | | | | | | |
| East Coastal Plain Pressure Area | | 8-1.01 | 99 | | | | + 6 1/2 | | | 6S/ 8W- 6Pl, S 203.5 | 6S/ 10W- 20Cl, S 2.3 | |
| Santa Ana Forebay Area | | 8-1.02 | 72 | | | | +16 | | | 4S/ 9W- 22Rl, S 347.2 | 4S/ 9W- 8Cl, S 10.3 | |
| Irvine Basin | | 8-1.03 | 10 | | | | + 7 1/2 | | | 6S/ 8W- 6Al, S 299.3 | 6S/ 9W- 10Rl, S 13.8 | |
| La Habra Basin | | 8-1.04 | 6 | | | | + 7 1/2 | | | 3S/ 11W- 2W2, S 215.7 | 3S/ 10W- 5Kl, S 12.7 | |
| Yorba Linda Basin | | 8-1.05 | 4 | | | | + 2 1/2 | | | 3S/ 9W- 20Ml, S 182.1 | 3S/ 9W- 34Cl, S 11.0 | |
| Santa Ana Narrows Basin | | 8-1.06 | 41 | | | | + 1 | | | 3S/ 8W- 29Nl, S 57.6 | 3S/ 7W- 20Ll, S 0.4 | |
| Upper Santa Ana Valley | | 8-2.00 | | | | | | | | | | |
| Chino Basin | | 8-2.01 | 49 | | | | - 1 1/2 | | | 1S/ 8W- 12Hl, S 586.0 | 2S/ 8W- 36Ql, S Flowing | |
| Claremont Heights Basin | | 8-2.02 | 7 | | | | +16* | | | 1N/ 8W- 25K3, S 455.0 | 1N/ 8W- 25K3, S 64.4 | |
| Cucamonga Basin | | 8-2.03 | 4 | | | | +36 | | | 1N/ 7W- 29R4, S 536.3 | 1S/ 7W- 9Dl, S 145.1 | |
| Rialto Basin | | 8-2.04 | 5 | | | | +14 | | | 1N/ 5W- 29Al, S 489.7 | 2N/ 6W- 26Ll, S 12.9 | |
| Colton Basin | | 8-2.05 | 4 | | | | - 1 1/2 | | | 1N/ 5W- 36H4, S 323.1 | 1S/ 4W- 21Ql, S 20.0 | |

ESTIMATED AVERAGE CHANGES IN GROUND WATER LEVEL ELEVATIONS IN
SELECTED GROUND WATER BASINS IN SANTA ANA REGION NO. 8
DURING 1957-58
(continued)

| Ground water basin | Name | Number | : analysis : | : in : | : the year, | : level during : | : in ground water : | : average change : | : Estimated : | Location and observed extremes | |
|------------------------------------|------|--------|--------------|--------|-------------|------------------|---------------------|--------------------|---------------|--------------------------------|---------------------------|
| | | | | | | | | | | of depth to ground water | during 1957-58, in feet |
| | | | | | | | | | | Maximum | Minimum |
| Upper Santa Ana Valley (continued) | | | | | | | | | | | |
| Bunker Hill Basin | | 8-2.06 | 43 | | + 2* | | | | | 1N/ 3W-28Pl, S 425.9 | 1S/ 4W-10M2, S Flowing |
| Lytle Basin | | 8-2.07 | 8 | | +43 | | | | | 1N/ 5W-15Q2, S 421.2 | 1N/ 5W-23H1, S 100.0 |
| Devil Canyon Basin | | 8-2.10 | 4 | | + 2 | | | | | 1N/ 4W- 8Pl, S 243.7 | 1N/ 4W-14R8, S 8.7 |
| Beaumont Basin | | 8-2.12 | 6 | | +10 | | | | | 2S/ 1W-34Q1, S 390.1 | 2S/ 1W- 2J1, S 6.3 |
| San Timoteo Basin | | 8-2.13 | 11 | | - 1/2 | | | | | 1S/ 2W-31B1, S 355.6 | 2S/ 3W-23H1, S 33.1 |
| Riverside Basin | | 8-2.15 | 24 | | + 4 | | | | | 1S/ 5W-23N1, S 216.6 | 3S/ 6W-11M2, S 3.7 |
| Arlington Basin | | 8-2.16 | 8 | | + 1* | | | | | 3S/ 5W-17Q1, S 70.1 | 2S/ 5W-31N1, S 4.2 |
| Temescal Basin | | 8-2.17 | 14 | | + 2 1/2 | | | | | 3S/ 7W-35C1, S 193.8 | 3S/ 7W-20H1, S 1.1 |
| Coldwater Basin | | 8-2.19 | 7 | | +46 | | | | | 5S/ 6W- 3Q1, S 227.5 | 5S/ 6W- 3G1, S 86.4 |
| Lasinore Valley | | | | | | | | | | | |
| | | 8-4.00 | 9 | | + 4 1/2 | | | | | 5S/ 5W-34Q2, S 360.0 | 6S/ 4W-28D1, S 6.3 |
| San Jacinto Valley | | | | | | | | | | | |
| | | 8-5.00 | 12 | | 0 | | | | | 5S/ 1E-21F1, S 312.8 | 4S/ 1W-18L1, S 7.2 |

Observed depth to ground water measurements indicated a significant rise of the water level elevations of the ground water basins in the Coastal Plain of Orange County. This is attributable, in part, to the deep percolation of a portion of the discharge of the Santa Ana River, which enters the Coastal Plain below Prado Dam, and the spreading of about 83,900 acre-feet of unsoftened Colorado River water in the Santa Ana Forebay Area. In the forebay, water level elevations rose an average of 16 feet from the summer of 1957 to the summer of 1958. Despite the recovery in the forebay, water level elevations to the west and south remained below sea level. The maximum observed depth to ground water was 347 feet at a well about two miles northeast of Orange. A minimum depth to water of about ten feet was observed at a well about one-half mile north of Olive.

Piezometric levels in the East Coastal Plain Pressure Area rose an average of about six feet between the summer of 1957 and the summer of 1958. Throughout most of the basin, however, the levels remained below sea level. Contours of ground water elevations presented on Plate 16 indicate that the piezometric surface underlying the East Coastal Plain Pressure Area was a maximum of 40 feet below sea level near the Orange County--Los Angeles County line. There was another ground water trough approximately parallel to the coast and about five miles inland, in the southwestern portion of the pressure area. The existence of a landward gradient in the piezometric surface provides conditions for the intrusion of sea water. This intrusion appears to be continuing in the Santa Ana gap.

Water level elevations rose in most of the major ground water basins in the Upper Santa Ana Valley, particularly near the San Gabriel Mountains. Observations of depths to ground water in Cucamonga and Lytle Basins indicated an average rise of over 35 feet.

An exception to the general trend of improved ground water conditions occurred in Chino Basin, where the average water level elevation declined about one and one-half feet between the summer of 1957 and the summer of 1958. This decline may have continued into 1957-58, because the larger quantities of percolating waters occurring during the season may not have as yet reached the main ground water body. In the northwestern portion of the basin between the Cities of Claremont and Upland, depths to water of over 585 feet were observed, and at the southwesterly edge of the basin, in the vicinity of Prado Dam, rising water was observed.

In Bunker Hill Basin, an average increase in elevation of about two feet occurred between the spring of 1957 and the spring of 1958. Observed depths to ground water ranged from 425 feet about one mile east of Patton to flowing near Colton. Water level elevations in wells adjacent to the Santa Ana River, two to three miles east of Colton, fluctuated through a range of over 50 feet between the summer of 1957 and the summer of 1958.

Ground water levels in the San Jacinto Valley, on the average, appear to have remained essentially stable during 1957-58. However, the hydrograph constructed for well No. 4S/LW-3541, S, in the San Jacinto Valley, on Plate 12B, indicates that the water level elevation at this well declined 1 feet between the spring of 1941 and the spring of 1957. Maximum observed depth to ground water in this valley was on the order of 310 feet. In the Elsinore Valley, observed ground water levels indicate a rise of an average of about four and one-half feet between the summer of 1957 and the summer of 1958. Maximum and minimum observed depths to water in this area were 360 feet and six feet, respectively.

The general rise of water levels in the basins of the San Diego Region indicates a considerable and much needed improvement in ground water conditions between the summers of 1957 and 1958. In this region, many of the basins are small, with limited storage and carry-over capacity. In the summer of 1957, storage in these basins was at very low levels as a result of the protracted drought which had extended through the five preceding years.

A rise of over ten feet in the average water level elevation was observed in both Bonsall Basin in the San Luis Rey Valley, and San Pasqual Basin in the San Pasqual Valley. Average water levels in Mission Basin in the San Luis Rey Valley, and in Tia Juana Valley rose about four feet and two and one-half feet, respectively. Although the observed water level elevations are higher than the previous year in wells adjacent to the coast line in the Mission Basin and Tia Juana Valley, observed water level elevations remained below sea level, so conditions which permit the intrusion of sea water continued to prevail.

Available measurements of depth to water for the San Diego Region are tabulated in Volume III, Appendix H, and pertinent statistics derived from them are summarized in Table 21. Hydrographs of selected wells in Region No. 9 are presented on Plate 12B, and the locations of wells for which hydrographs are presented are shown on Plate 11.

TABLE 21

ESTIMATED AVERAGE CHANGES IN GROUND WATER LEVEL ELEVATIONS IN
SELECTED GROUND WATER BASINS IN SAN DIEGO REGION NO. 9
DURING 1957-58

| Ground water basin | : : : Estimated | | | : : Location and observed extremes | |
|----------------------|-----------------|-------------------|------------------------------|------------------------------------|---------------------------|
| | : Number of | : average change | : : of depth to ground water | : : during 1957-58, in feet | |
| | : wells | : in ground water | : : level during | : : the year, | |
| | : considered: | : in | : : in feet | : : Maximum | : Minimum |
| Name | : Number | : analysis | : : in feet | : : Maximum | : Minimum |
| San Juan Valley | 9- 1.00 | | | | |
| Aliso Creek Basin | 9- 1.01 | 16 | + 5 | 6S/ 8W-26F5,S 70.8 | 6S/ 8W-23R1,S 7.5 |
| San Juan Creek Basin | 9- 1.02 | 49 | + 1 1/2 | 8S/ 7W- 5C1,S 125.6 | 8S/ 8W-13D1,S 3.2 |
| Temecula Valley | 9- 5.00 | | | | |
| Murrieta Basin | 9- 5.01 | 5 | + 2 | 6S/ 4W-27M1,S 139.6 | 8S/ 3W-13K1,S 13.2 |
| Pauba Basin | 9- 5.02 | 2 | - 3 1/2 | 8S/ 2W-12H1,S 62.6 | 8S/ 2W-11L1,S 31.2 |
| San Luis Rey Valley | 9- 7.00 | | | | |
| Mission Basin | 9- 7.01 | 5 | + 4 | 11S/ 4W-18L3,S 79.5 | 11S/ 5W-13N2,S 16.9 |
| Bonsall Basin | 9- 7.02 | 16 | +13 | 10S/ 3W-16F1,S 56.4 | 10S/ 3W-20E1,S 7.9 |
| San Pasqual Valley | 9-10.00 | | | | |
| Lake Hodges Basin | 9-10.01 | 5 | + 6 1/2* | 13S/ 2W- 2Q1,S 69.6 | 13S/ 2W- 2D3,S 13.0 |
| San Pasqual Basin | 9-10.02 | 50 | +11 | 12S/ 1W-30A5,S 65.5 | 12S/ 1W-33L2,S Flowing |

ESTIMATED AVERAGE CHANGES IN GROUND WATER LEVEL ELEVATIONS IN
SELECTED GROUND WATER BASINS IN SAN DIEGO REGION NO. 9
DURING 1957-58
(continued)

| Ground water basin | : Number of : : wells : : considered : : in : : analysis : | : Estimated : : average change : : in ground water : : level during : : the year, : : in feet : | : Location and observed extremes : of depth to ground water : during 1957-58, in feet | |
|--------------------------------|--|--|---|-----------------------|
| | | | Maximum | Minimum |
| San Pasqual Valley (continued) | | | | |
| Felicita Basin | 9-10.03 18 | + 7 1/2* | 12S/ 2W-28P1,S 82.0 | 12S/ 2W-24R1,S 0.0 |
| Santa Maria Valley | 9-11.00 | | | |
| Ramona Basin | 9-11.01 15 | + 6 | 12S/ 1E-34Q1,S 64.6 | 13S/ 1W-24K1,S 2.3 |
| San Dieguito Valley | 9-12.00 | | | |
| San Dieguito Basin | 9-12.01 8 | + 8* | 13S/ 3W-33B1,S 56.0 | 14S/ 4W- 1Q1,S 3.1 |
| Sweetwater Valley | 9-17.00 7 | + 5 1/2 | 17S/ 2W-25P4,S 29.0 | 16S/ 1E-30R1,S 2.0 |
| Tia Juana Valley | 9-19.00 43 | + 2 1/2 | 18S/ 2W-27R2,S 92.8 | 18S/ 2W-32J5,S 4.4 |

*Average change in ground water level elevations for period spring, 1957, to spring, 1958.

CHAPTER IV. QUALITY OF WATER AND SEA-WATER INTRUSION

The recharge of better than average amounts of stream flow in many of the unconfined ground water basins of Southern California resulted in general improvement of the quality of ground water of these basins. However, very little improvement was noted in the quality of ground waters in confined basins. The principal water quality problem in Southern California is still the intrusion of sea water in coastal ground water basins. In most areas, saline fronts advanced during 1957-58 with very little, if any, mitigation as the result of better water conditions.

The following sections present summary information on quality of surface and ground waters and on the current status of sea-water intrusion.

Water Quality

Results of mineral analyses of surface and underground waters vary considerably within the various basins, making detailed evaluations of changes from year to year difficult and lengthy. Summary evaluations of water quality changes are presented in the Bulletin No. 65 series of the Department of Water Resources, entitled "Quality of Surface Waters of California", and the Bulletin No. 66 series of Department of Water Resources, entitled "Quality of Ground Waters in California". Bulletins in these series for the year 1958 are current being prepared. For the purpose of this Bulletin No. 39-58, mineral analyses of water samples collected during 1957-58 at selected surface and underground points in each basin were compiled. These analyses are presented in Tables 22 and 23. The analyses shown are intended only to give a general indication of water quality at the various locations and are not necessarily representative of the average conditions in a stream or basin.

TABLE 22

MINERAL ANALYSES OF SURFACE WATER AT
SELECTED STATIONS IN SOUTHERN CALIFORNIA

| Station number | Station | Date : sampled : : and : : estimated: 25°C : discharge: | Mineral constituents, in parts per million | | | | | | | | | | Total : : hardness : : as CaCO ₃ , : : Na : : in ppm : |
|-------------------|---|---|--|----|------|------------------|-----------------|-----|-----------------|-----|--|--|---|
| | | | Ca | Mg | Na+K | HCO ₃ | SO ₄ | Cl | NO ₃ | B | | | |
| 37-121.7 | Salinas River, U.S.G.S. gage at old State Highway 41 bridge at Paso Robles | 5-6-58 100 cfs | 78 | 28 | 42 | 270 | 107 | 38 | 2 | 0.1 | | | 320 22 |
| 318-35.5 | Santa Ynez River at Mission Bridge, 0.9 mile S. of Solvang | 5-8-58 290 cfs | 84 | 37 | 39 | 244 | 195 | 21 | 1 | 0.3 | | | 371 18 |
| 42-5.7 | Ventura River, N. of Ventura, in Foster Memorial Park, 300 feet down- stream from highway bridge at U.S.G.S. gaging station | 5-5-58 215 cfs | 102 | 34 | 38 | 232 | 229 | 25 | 4 | 0.3 | | | 396 17 |
| 43-17.0 | Santa Clara River, E. of Santa Paula and about 1.5 miles upstream from Willard Bridge | 5-5-58 300 cfs | 108 | 37 | 57 | 203 | 315 | 27 | 2 | 0.6 | | | 423 22 |
| 47-23.9 | Los Angeles River, NE. of Los Angeles at Figueroa Street | 5-8-58 2.5 cfs | 89 | 45 | 235 | 337 | 315 | 278 | 4 | 0.8 | | | 408 55 |

MINERAL ANALYSES OF SURFACE WATER AT
SELECTED STATIONS IN SOUTHERN CALIFORNIA
(continued)

| Station number | Station | Date sampled | ECx10 ⁶ and estimated: 25°C discharge: | Mineral constituents, in parts per million | | | | | | | Total | | Per cent |
|-------------------|--|--------------------|--|--|----|------|------------------|-----------------|-----|-----------------|-------|--|-------------|
| | | | | Ca | Mg | Na+K | HCO ₃ | SO ₄ | Cl | NO ₃ | B | hardness as CaCO ₃ , in ppm | |
| 47-12.2-9.6 | Rio Hondo, NE. of Montebello about 0.1 mile upstream from San Gabriel Blvd. bridge | 5-6-58 222 cfs | 1,083 | 87 | 29 | 110 | 160 | 296 | 96 | 2 | 0.2 | 337 | 40 |
| 48-20.7 | San Gabriel River, SW. of El Monte and 0.5 mile up- stream from Whittier Narrows Dam | 5-6-58 160 cfs | 302 | 39 | 12 | 11 | 155 | 222 | 9 | 3 | 0.0 | 145 | 10 |
| 82-57.9-2.0 | Warm Creek, San Bernardino at "E" Street | 5-12-58 2.5 cfs | 377 | 47 | 9 | 23 | 140 | 59 | 19 | 2 | 0.0 | 156 | 22 |
| 82-45.2 | Santa Ana River, Pedley Bridge N. of Arlington | 5-6-58 28 cfs | 992 | 106 | 27 | 81 | 327 | 102 | 109 | 18 | 0.1 | 376 | 30 |
| 93-20.0 | Santa Margarita River, N. of Fall- brook, about 0.5 mile downstream from confluence with Sandia Creek | 5-5-58 17 cfs | 827 | 54 | 27 | 86 | 246 | 84 | 101 | 1 | 0.2 | 248 | 42 |

MINERAL ANALYSES OF SURFACE WATER AT
SELECTED STATIONS IN SOUTHERN CALIFORNIA
(continued)

| Station number | Station | Date : sampled : : and : : estimated: at : : discharge: 25°C : | ECx10 ⁶ | Mineral constituents, in parts per million | | | | | | | | Total : hardness : : as CaCO ₃ : : in ppm : | Per cent : Na |
|-------------------|--|--|--------------------|--|------|--------|--------------------|--------------------|------|-------------------|-----|---|---------------------|
| | | | | Ca : | Mg : | Na+K : | HCO ₃ : | SCl ₄ : | Cl : | NO ₃ : | B : | | |
| 94-28.0 | San Luis Rey River, SE. of Pala at Pala Diversion Dam | 5-5-58 6 cfs | 531 | 48 | 21 | 33 | 200 | 130 | 31 | 1 | 0.0 | 207 | 22 |
| 620A-28.8 | Big Rock Creek, SE. of Pearblossom and about 300 feet upstream from confluence with Pallett Creek | 3-19-58 70 cfs | 371 | 42 | 16 | 13 | 174 | 22 | 23 | 0 | 0.4 | 170 | 10 |
| 619-95 | Mojave River, NW. of Victorville, about 0.2 mile SE. of U.S. Highway No. 91 bridge | 5-7-58 105 cfs | 246 | 22 | 8 | 21 | 107 | 16 | 15 | 1 | 0.0 | 88 | 32 |

TABLE 23

MINERAL ANALYSES OF GROUND WATER AT
SELECTED WELLS IN SOUTHERN CALIFORNIA

| State Well Number | Owner and location | Date sampled | ECx10 ⁶ at 25°C | Ca | Mg | NA+K | HCO ₃ | SO ₄ | Cl | NO ₃ | B | Mineral constituents, in parts per million | Total hardness as CaCO ₃ , in ppm | Per cent Na |
|---|---|--------------------|----------------------------------|------------|------------|------------|------------------|-----------------|------------|-----------------|------------|--|---|----------------|
| Central Coastal Region | | | | | | | | | | | | | | |
| <u>Santa Maria River Valley</u> | | | | | | | | | | | | | | |
| 10N/34W-19H1 | 1.0 mile N. of Betteravia Road on Black Road, just W. of Black Road | 5-7-58 9-16-58 | 1,259 1,277 | 120 134 | 61 63 | 87 82 | 238 254 | 417 423 | 70 80 | 11 12 | 0.6 0.1 | 550 594 | 25 22 | |
| <u>Lompoc Subarea, San Ynez River Valley</u> | | | | | | | | | | | | | | |
| 7N/35W-22L1 | U. S. Army, Camp Cooke; 2,500 feet N. of Southern Pacific Rail- road and 25 feet W. of Renwish Avenue | 6-16-58 9-18-58 | 1,988 2,095 | 129 125 | 112 112 | 164 181 | 288 201 | 355 357 | 378 420 | 13 15 | 0.2 0.4 | 786 773 | 30 32 | |
| <u>Los Angeles Region</u> | | | | | | | | | | | | | | |
| <u>Oxnard Plain Pressure Area, Santa Clara River Valley</u> | | | | | | | | | | | | | | |
| 1N/22W-3F4 | City of Oxnard; 200 feet E. of Saviers Road, 100 feet N. of Third Street | 4-22-58 | 1,622 | 179 | 61 | 111 | 308 | 554 | 61 | 2 | 0.1 | 695 | 25 | |

MINERAL ANALYSES OF GROUND WATER AT
SELECTED WELLS IN SOUTHERN CALIFORNIA
(continued)

| State Well Number | Owner and location | Date sampled | Mineral constituents, in parts per million | | | | | | | | | | Total | |
|----------------------|--------------------|-----------------|--|----|----|------|------------------|-----------------|----|-----------------|---|----------------------|----------|-----|
| | | | ECx10 ⁶ | | | | | | | | | | hardness | Per |
| | | | at | Ca | Mg | Na+K | HCO ₃ | SO ₄ | Cl | NO ₃ | B | as CaCO ₃ | cent | |
| | | | 25° C | | | | | | | | | in ppm | Na | |

Los Angeles Region (continued)

Oxnard Plain Forebay Area, Santa Clara River Valley

| | | | | | | | | | | | | | |
|-------------|---|----------|-------|-----|----|-----|-----|-----|----|---|-----|-----|----|
| 2N/22W-12G1 | United Concrete Pipe Corporation; One mile SE. of Saticoy, 200 feet NE. of Del Norte Avenue, 500 feet SE. of Vineyard Avenue | 11-27-57 | 2,052 | 189 | 77 | 176 | 317 | 775 | 93 | 1 | 0.6 | 790 | 32 |
|-------------|---|----------|-------|-----|----|-----|-----|-----|----|---|-----|-----|----|

Central Coastal Plain Pressure Area, Coastal Plain (Los Angeles County)

| | | | | | | | | | | | | | |
|------------|--|----------|-----|----|----|----|-----|----|----|---|-----|-----|----|
| 3S/12W-8F1 | Los Angeles County Farm; Two miles SW. of Downey, 1,600 feet S. and 300 feet W. of intersection with Imperial hwy. and N. of County Farm Road | 10-23-58 | 488 | 58 | 10 | 33 | 226 | 42 | 16 | 4 | 0.1 | 188 | 25 |
|------------|--|----------|-----|----|----|----|-----|----|----|---|-----|-----|----|

Montebello Forebay Area, Coastal Plain (Los Angeles County)

| | | | | | | | | | | | | | |
|-------------|---|----------|-----|----|----|----|-----|-----|----|---|-----|-----|----|
| 2S/11W-19L1 | La Habra Heights Water Company, Judson No. 3 well; Two miles W. of Whittier, 1,050 feet W. of Norwalk Blvd., 1,600 feet from Dunbar | 10-16-58 | 815 | 89 | 24 | 45 | 208 | 148 | 63 | 9 | 0.0 | 321 | 22 |
|-------------|---|----------|-----|----|----|----|-----|-----|----|---|-----|-----|----|

MINERAL ANALYSES OF GROUND WATER AT
SELECTED WELLS IN SOUTHERN CALIFORNIA
(continued)

| State Well Number | Owner and location | Date sampled | :ECx10 ⁶ | Mineral constituents, in parts per million | | | | | | | : Total : hardness : Per : as CaCO ₃ , cent : in ppm : Na |
|----------------------|--------------------|-----------------|---------------------|--|------|--------|--------------------|-------------------|------|-------------------|---|
| | | | | : Ca | : Mg | : Na+K | : HCO ₃ | : SO ₄ | : Cl | : NO ₃ | |

Los Angeles Region (continued)

San Fernando Basin, San Fernando Valley

| | | | | | | | | | | | | | | | |
|-------------|--|---------|-----|----|----|----|----|-----|----|----|----|-----|-----|----|----|
| 1N/14W-17H1 | Polar Water Company; Three miles W. of Burbank, 198 feet S. of Burbank Blvd., 154 feet E. of Denny Avenue | 9-24-58 | 864 | -- | -- | -- | -- | 262 | -- | 38 | -- | --- | 395 | -- | -- |
|-------------|--|---------|-----|----|----|----|----|-----|----|----|----|-----|-----|----|----|

Main San Gabriel Basin, San Gabriel Valley

| | | | | | | | | | | | | | | | |
|------------|---|---------|-----|----|----|----|-----|----|----|----|-----|-----|----|--|--|
| 1S/11W-2G1 | City of Monrovia; Three miles S. of Monrovia, 400 feet E. of Peck Rd., 200 feet N. of Jeffries Avenue | 11-7-58 | 668 | 86 | 29 | 23 | 310 | 30 | 28 | 73 | 0.0 | 332 | 12 | | |
|------------|---|---------|-----|----|----|----|-----|----|----|----|-----|-----|----|--|--|

Pasadena Subarea, San Gabriel Valley

| | | | | | | | | | | | | | | | |
|-------------|---|------------------|-----|----------|----------|----------|------------|----------|----------|--------|-----|-----|------------|----------|--|
| 1N/12W-20B1 | City of Pasadena, Copelin Well; Pasadena, 142 feet E. of Mentone Avenue, 118 feet N. of Manzanita Street | 1-6-58 5-5-58 | --- | 53 44 | 18 14 | 25 24 | 211 190 | 40 25 | 21 16 | 8 7 | --- | --- | 205 164 | 21 24 | |
|-------------|---|------------------|-----|----------|----------|----------|------------|----------|----------|--------|-----|-----|------------|----------|--|

MINERAL ANALYSES OF GROUND WATER IN
SELECTED WELLS IN SOUTHERN CALIFORNIA
(continued)

| State Well Number | Owner and location | Date sampled | ECx10 ⁶ at 25°C | Ca | Mg | Na+K | HCO ₃ | SO ₄ | Cl | NO ₃ | B | Total hardness in ppm | Per cent Na |
|--|---|---------------------|----------------------------------|----------|----------|----------|------------------|-----------------|----------|-----------------|-----------|-----------------------------|-------------------|
| <u>Lahontan Region</u> | | | | | | | | | | | | | |
| <u>Lancaster Basin, Upper Santa Ana Valley</u> | | | | | | | | | | | | | |
| 8N/13W-32N1 | Pedro Limanaga; 100 feet E. of 90th Street, W. and 100 feet N. of Avenue "G" | 9-5-58 | 596 | 55 | 10 | 57 | 205 | 39 | 56 | 20 | 0.3 | 170 | 46 |
| <u>Santa Ana Region</u> | | | | | | | | | | | | | |
| <u>East Coastal Plain Pressure Area, Coastal Plain (Orange County)</u> | | | | | | | | | | | | | |
| 4S/11W-36N1 | Mountain Properties, Inc.; Three miles N. of Garden Grove, 125 feet S. of Stanford Avenue, 253 feet E. of Sycamore Street | 12-24-57 6-12-58 | 525 590 | -- -- | -- -- | -- -- | 214 211 | -- 44 | 27 23 | -- -- | -- -- | 180 157 | -- -- |
| <u>Chino Basin, Upper Santa Ana Valley</u> | | | | | | | | | | | | | |
| 15W-21D1 | City of Ontario, No. 4 well; Two miles NE. of Ontario, 90 feet S. of 4th St., 300 feet E. of Grove | 12-26-57 7-18-58 | 381 326 | 45 -- | 9 -- | 19 -- | 183 161 | 15 -- | 10 6 | 11 -- | 0.0 -- | 115 112 | 20 -- |

MINERAL ANALYSES OF GROUND WATER AT
SELECTED WELLS IN SOUTHERN CALIFORNIA
(continued)

| State Well Number | Owner and location | Date sampled | ECx10 ⁶ at 25°C | Ca | Mg | Na+K | HCO ₃ | SO ₄ | Cl | NO ₃ | B | Total hardness as CaCO ₃ in ppm | Per cent Na |
|---|---|---------------------|----------------------------------|------------|----------|------------|------------------|-----------------|------------|-----------------|------------|---|-------------------|
| Santa Ana Region (continued) | | | | | | | | | | | | | |
| Bunker Hill Basin, Upper Santa Ana Valley | | | | | | | | | | | | | |
| 1S/4W-15M2 | Meeks and Daley Water Company; 0.7 mi. S. of Mill St., 100 feet W. of "E" St. | 7-10-58 | 650 | 60 | 9 | 43 | 214 | 68 | 25 | 2.0 | 0.1 | 185 | 31 |
| San Diego Region | | | | | | | | | | | | | |
| Mission Basin, San Luis Rey River Valley | | | | | | | | | | | | | |
| 11S/4W-18C1 | 2,900 feet NE. from pgg. plt., along Hwy 76, 1,760 feet NW. along private road, 15 feet SW. of road | 3-19-58 10-28-58 | 1,493 1,338 | -- 84 | -- 39 | 136 | 292 | 135 | 260 215 | --- | 0.0 | 445 370 | -- 43 |
| Via Juana Valley | | | | | | | | | | | | | |
| 19S/2W-4A5 | California Water and Telephone Company, Well No. 5; South Basin Plant three miles W. of National Ave., 1,500 feet S. of Sunset Avenue | 12-18-57 5-29-58 | 2,033 2,380 | 137 122 | 55 74 | 268 280 | 364 317 | 244 270 | 416 464 | 1 5 | 0.3 0.2 | 568 608 | 50 49 |

Sea-Water Intrusion

The movement of sea water into the fresh water aquifers of coastal ground water basins of Southern California continued during 1957-58. The Oxnard Plain Pressure Area of Ventura County, the West Coast Basin of Los Angeles County, and East Coastal Plain Pressure Area of Orange County are the major basins which experience this problem, and the status of sea-water intrusion in these basins is discussed hereafter. Because of limitations of available information, other smaller basins which have experienced intrusion are not treated.

A detailed description of the location and hydrologic features of the afore-mentioned basins, as well as the history of sea-water intrusion and the corrective measures undertaken, may be found in Bulletin No. 39-57, Volume I, of this series of reports. A detailed study of sea-water intrusion in California as a whole may be found in Department of Water Resources Bulletin No. 63.

Oxnard Plain Pressure Area

Isochlors, outlining areas where chloride ion concentrations of 100 and 500 parts per million (ppm) were found in ground waters during the spring of 1958, are presented on Plate 13 for the Oxnard Plain Pressure Area. Ground water level contours for June, 1958, are also indicated on this plate. These data indicate that movement of sea water has been generally landward during the past year and that intrusion continues in two apparently separated areas, one centering around Port Hueneme and the other near Mugu Lagoon.

In the Port Hueneme area, a significant advance of sea water into fresh water aquifers has occurred during the past year. In the area between Hueneme Road and Pleasant Valley Road, the lines of 100 ppm and 500 ppm of chlorides

advanced eastward for distances as great as 1,700 feet. Water level contours indicate a pumping depression a mile and one-half to the east of this area and a greater landward gradient in that direction. In the area just west of Ventura Road, the 100 ppm and 500 ppm chloride lines moved northward 1,000 feet. No significant movement was evident on the other fronts in this area. The maximum landward advance of the 500 ppm isochlor is now 1.8 miles, as compared with 1.5 miles in the spring of 1957.

Fluctuations of the chloride content in well 1N/22W-17J2,3, near Port Hueneme, from 1956 through 1958 are presented graphically on Plate 14.

In the vicinity of Mugu Lagoon, the extent of intrusion cannot be accurately determined, because the absence of water wells prevents the acquisition of essential data. The 100 and 500 ppm chloride lines are shown generally in the same position for 1958 as for 1957.

West Coast Basin

Sea water has intruded the fresh water aquifers of West Coast Basin along the entire coast line, bordering on Santa Monica Bay, from Palos Verdes Hills to Ballona gap. Lines of equal chloride concentration of 250, 500, and 1,000 ppm for spring, 1958, are presented on Plate 15, together with the water level contours for June, 1958.

In the spring of 1958, the 500 ppm isochlor was, on the average, a distance of one and a quarter miles inland from the coast. The 250 ppm isochlor line is located an average distance of 1,000 feet farther inland along the sea-water front.

Between Manhattan Beach Boulevard and Redondo Beach Boulevard is the Experimental Fresh Water Barrier Project of the Los Angeles County Flood Control District. This project is an effort to retard the landward movement of sea water

by injecting fresh water into the intruded aquifer to build up a fresh water ridge. Although many mineral analyses are available for this area, the picture presented is not entirely clear. It is evident that a considerable area of less-than-500-ppm-chloride water exists immediately inland from the line of injection wells. Landward of this area of injected water are wells with waters containing more than 1,000 ppm of chloride. Whether these high-chloride waters originated when the leading edge of the intrusion wedge was severed and driven inland by the injected fresh water, or by the movement of high-chloride water around the ends of the fresh water barrier, is not yet determined.

Fluctuations of the chloride content of water in well 38/14W-30Q1,S, in Manhattan Beach, during the period 1954 through 1957 are shown on Plate 14.

East Coastal Plain Pressure Area

Lines of equal chloride concentration of 50, 100 and 500 ppm in the East Coastal Plain Pressure Area for the spring of 1958 are presented on Plate 16, which also shows water level contours for June, 1958.

Sea water has intruded a considerable part of Santa Ana gap, and this movement continued during 1957-58. The 500 ppm isochlor line has advanced inland as far as three miles, and as much as one-half mile along the flanks of the gap, indicating a rapid landward movement of sea water.

Fluctuations of the chloride content of waters in well 6S/10W-6L2,S, in the Santa Ana gap, during the period 1951 through 1958 are shown on Plate 14.

CHAPTER V

CONSTRUCTION ACTIVITIES AFFECTING WATER SUPPLY CONDITIONS

Although water-related construction activities are not in themselves items of water supply, they directly affect water supply conditions in Southern California. For this reason, a brief outline of the important activities occurring during the 1957-58 season is presented below.

Construction of Dams

Four dams were completed during the period encompassed by this report and other projects were in various stages of completion at the end of September 1958. The majority of these facilities are for water conservation, regulation, and flood control. Table 24 lists the various dam projects with reservoir storage capacities over 100 acre-feet which were under construction during the 1957-58 water year, together with approximate dates of starting and completion and the agencies responsible for the work.

Colorado River Aqueduct

During 1957-58, The Metropolitan Water District of Southern California continued construction work on the Colorado River Aqueduct aimed at completion to full capacity in 1960. Work was completed on enlargement of pumping plant structures and installation of the sixth pumping unit at each plant.

Work continued on the addition of three pumping units to each plant so that there will be a total of nine at each plant and the construction of the third delivery line to each of these plants was well advanced. Substantial progress was made on construction of the second barrel of the double-barreled siphon installations along the aqueduct. Construction of final stage canal and

TABLE 24

DAM PROJECTS* COMPLETED OR UNDER CONSTRUCTION IN SOUTHERN CALIFORNIA
DURING WATER YEAR 1957-58

| Dam Project | Construction period | Agency responsible | Purpose | Location | Reservoir capacity, in acre-feet |
|-----------------------------|------------------------|---|---|--|--|
| | Started:Completed: | for construction: | : | : | : |
| Twitchell Dam (Vaquero) | 6-56 Incomplete | U.S. Bureau of Reclamation | Conservation Flood control Recreation | Cuyama River Santa Barbara and San Luis Obispo Counties | 240,000 |
| Casitas Dam | 8-56 Incomplete | U.S. Bureau of Reclamation | Conservation Flood control Recreation | Coyote Creek Ventura County | 250,000 |
| Little Mountain Dam | 9-57 2-58 | San Bernardino County Flood Control District | Flood control | Devil Canyon Creek San Bernardino County | 150 |
| Pigeon Pass Dam | 6-57 11-57 | Riverside County Flood Control and Water Conservation District | Flood control | Pigeon Pass Creek Riverside County | 210 |
| Palo Verde Diversion Dam | 2-56 12-57 | U.S. Bureau of Reclamation | Diversion for irrigation | Colorado River at Blythe Riverside County | None |
| San Marcos Dam | 8-57 6-58 | San Marcos County Water District | Terminal storage | Tributary San Marcos Creek San Diego County | 320 |

*Greater than 100 acre-feet capacity

siphon between San Jacinto tunnel and Lake Mathews was scheduled for 1958-59. The entire program was on schedule and completion by June, 1960, appeared to be ensured.

Main Conveyance and Distribution

Work was carried forward on construction of the second San Diego Aqueduct. The San Diego Water Authority had under contract the construction of the northerly 28.8 miles of the 59.0-mile southern portion from six miles south of the northern county line to Otay Reservoir. By June 30, 1958, about 3.5 miles of pipe had been laid. The remaining southern section was scheduled for 1958-59. During 1957-58, The Metropolitan Water District awarded construction contracts for portions of the 34-mile canal and pipeline sections of the aqueduct leading from San Jacinto tunnel to six miles south of the north line of San Diego County. The entire aqueduct is scheduled for completion in late 1960.

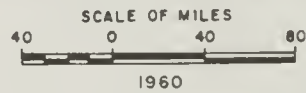
The Metropolitan Water District continued construction work on the Middle and Lower Feeders of its main distribution system. Work was completed on the following sections of pipeline:

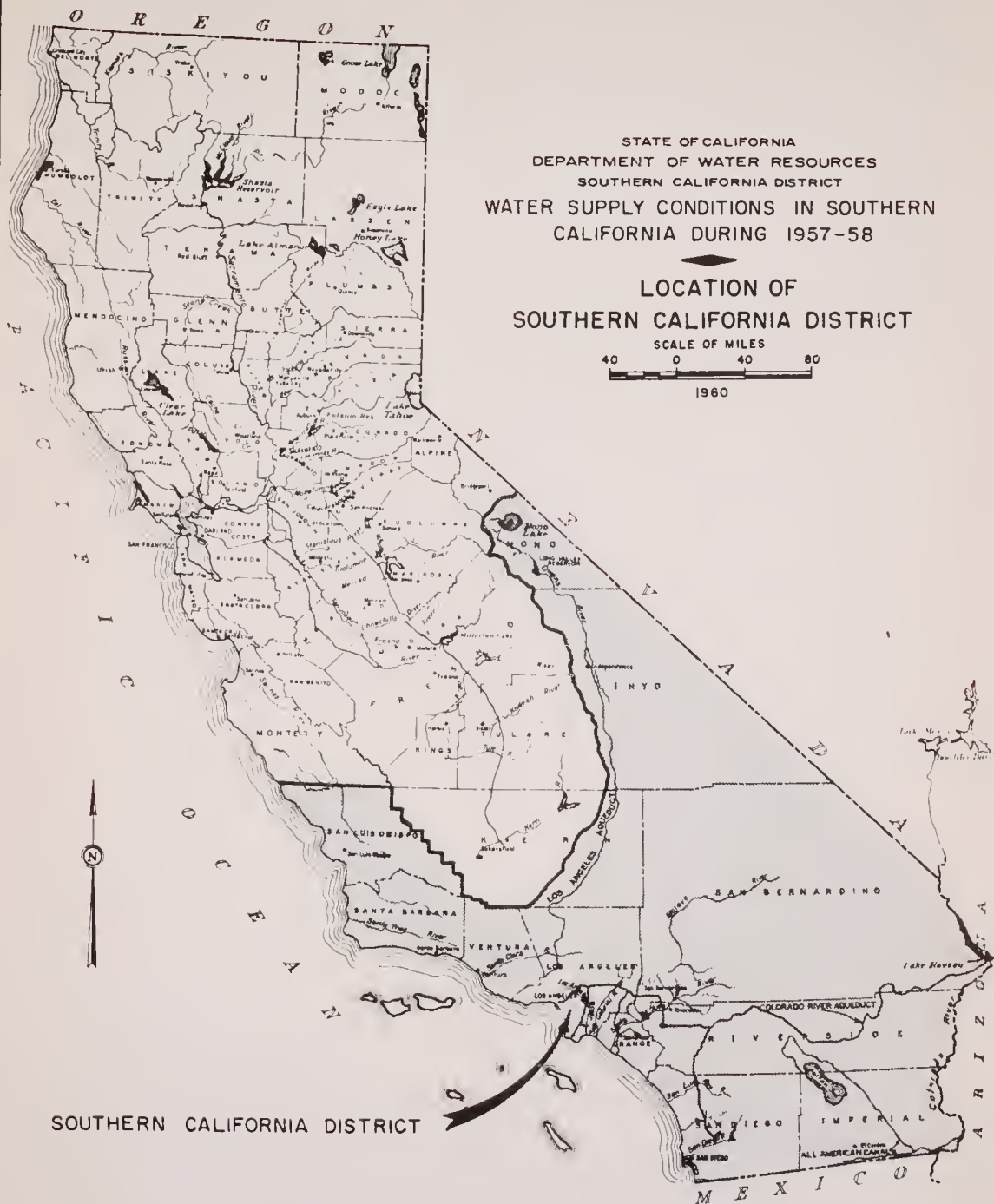
- Middle Feeder - LaVerne to Baldwin Park
- Baldwin Park to South San Gabriel
- South San Gabriel to Garvey Reservoir

Work was 86 per cent completed on the Culver City Feeder, Fortuna Street to 11th Avenue, and essentially completed on the same feeder from 11th Avenue to Westminster Avenue. Construction was well along on the section of the Lower Feeder from Santa Ana Canyon to the East Boundary of Los Angeles County. The latter work was scheduled for completion in March, 1959.

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
SOUTHERN CALIFORNIA DISTRICT
WATER SUPPLY CONDITIONS IN SOUTHERN
CALIFORNIA DURING 1957-58

LOCATION OF
SOUTHERN CALIFORNIA DISTRICT







LEGEND

MEAN SEASONAL PRECIPITATION FOR 50 YEAR PERIOD 1897-1947

- LESS THAN 10 INCHES
- 10 TO 20 INCHES
- 20 TO 30 INCHES
- MORE THAN 30 INCHES

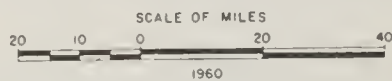
20 50 YEAR MEAN ISOHYETAL LINES

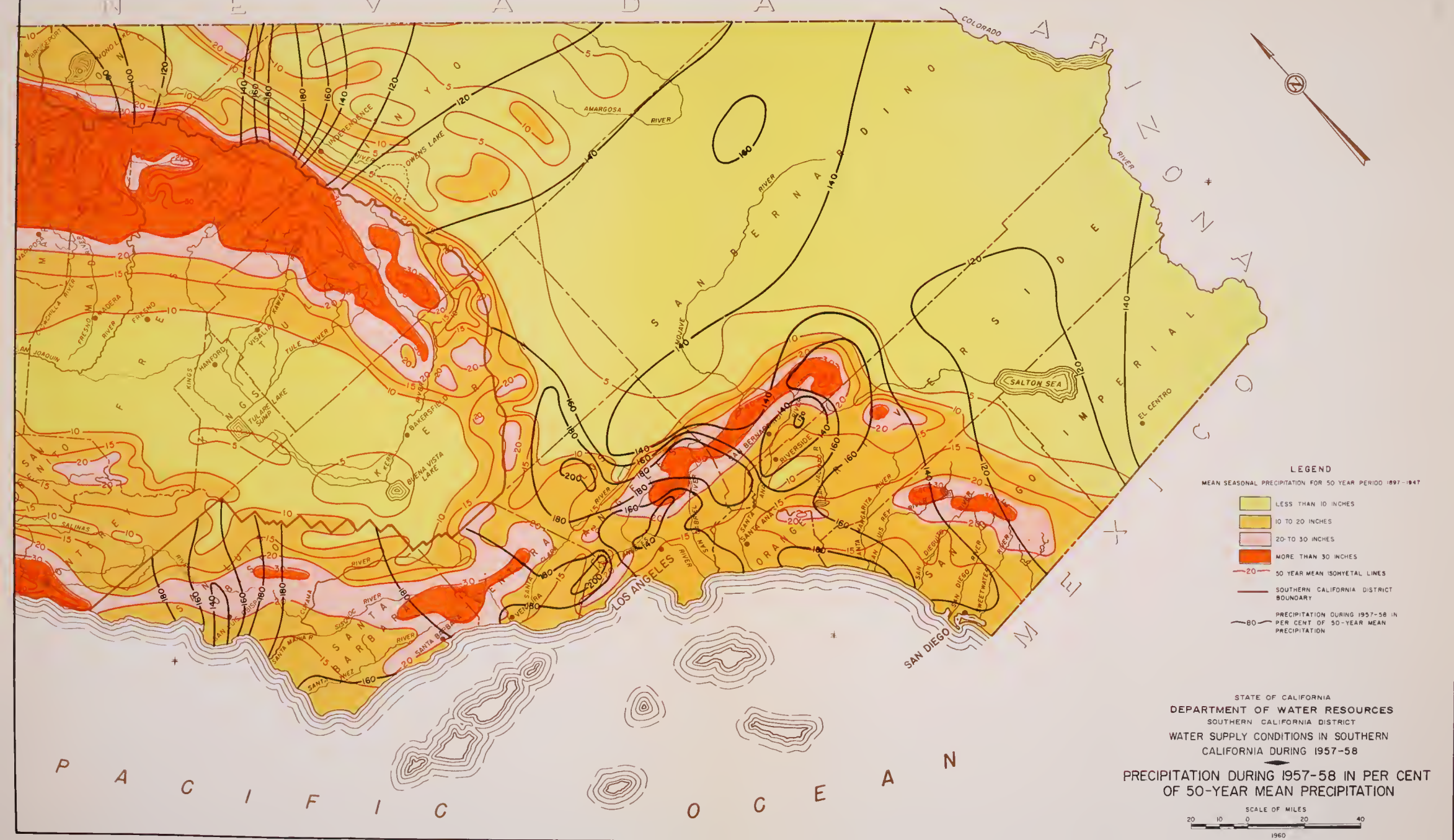
SOUTHERN CALIFORNIA DISTRICT BOUNDARY

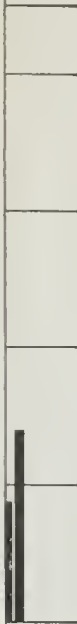
80 PRECIPITATION DURING 1957-58 IN PER CENT OF 50-YEAR MEAN PRECIPITATION

STATE OF CALIFORNIA
 DEPARTMENT OF WATER RESOURCES
 SOUTHERN CALIFORNIA DISTRICT
 WATER SUPPLY CONDITIONS IN SOUTHERN CALIFORNIA DURING 1957-58

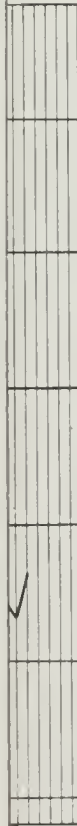
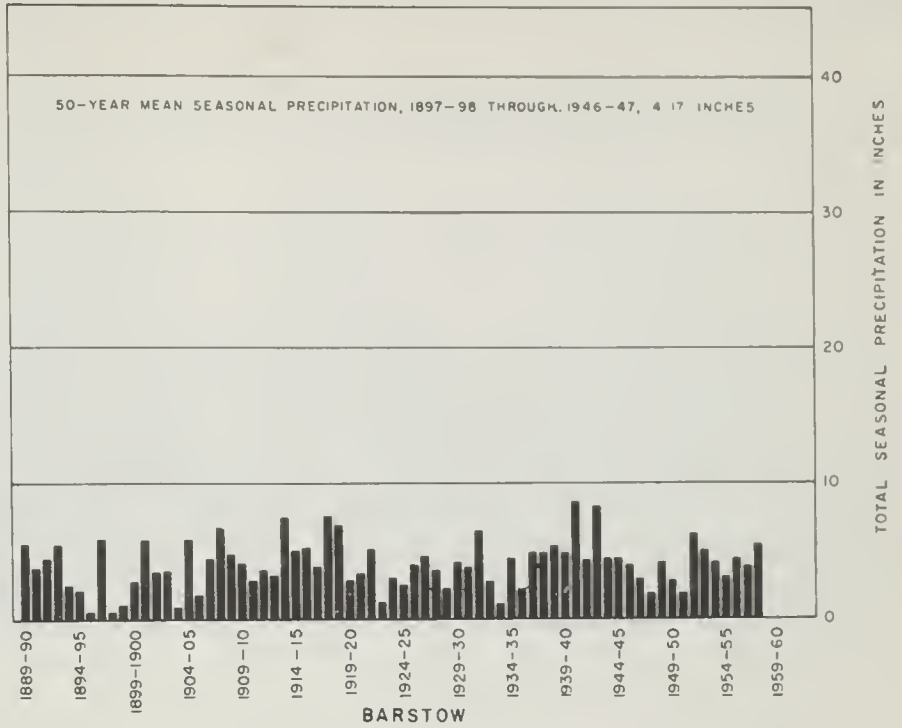
PRECIPITATION DURING 1957-58 IN PER CENT OF 50-YEAR MEAN PRECIPITATION



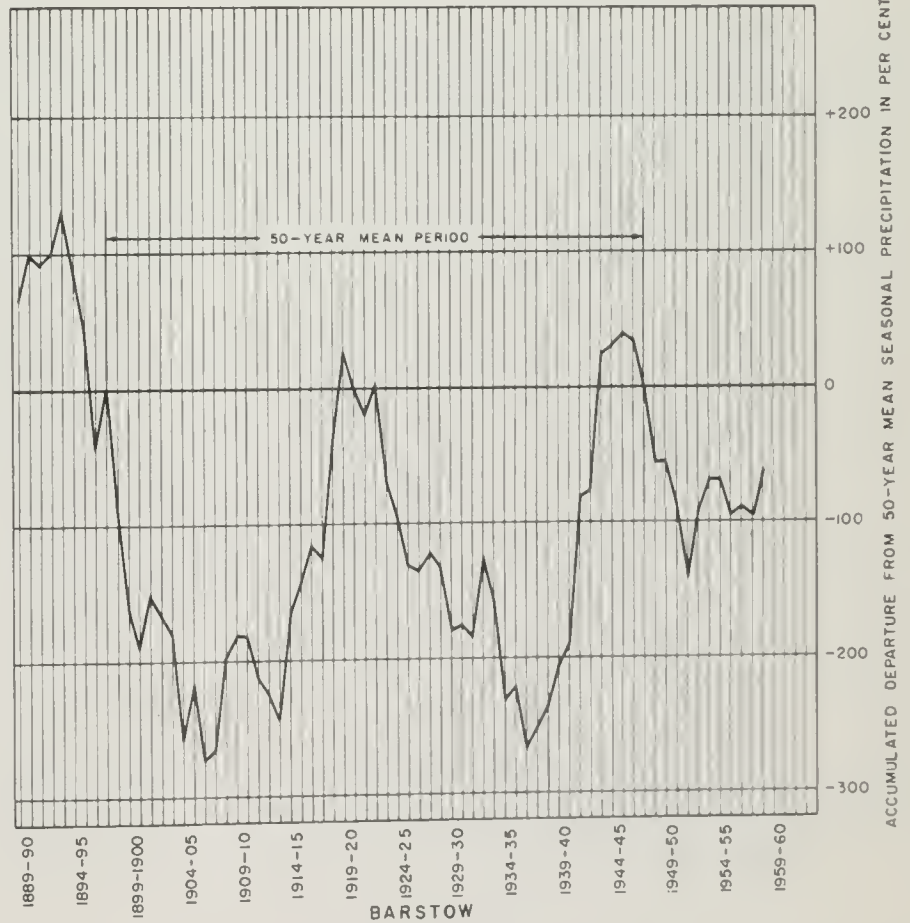




1959-60



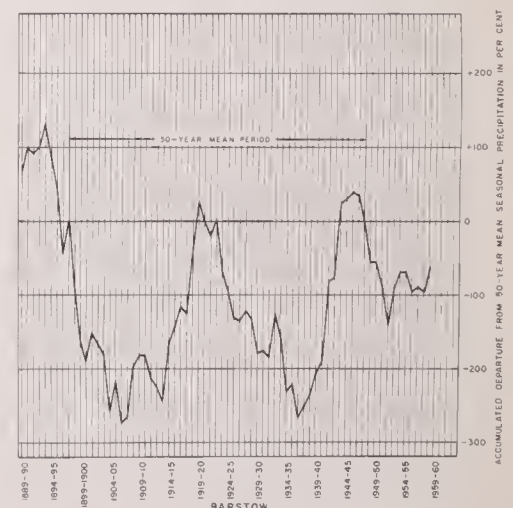
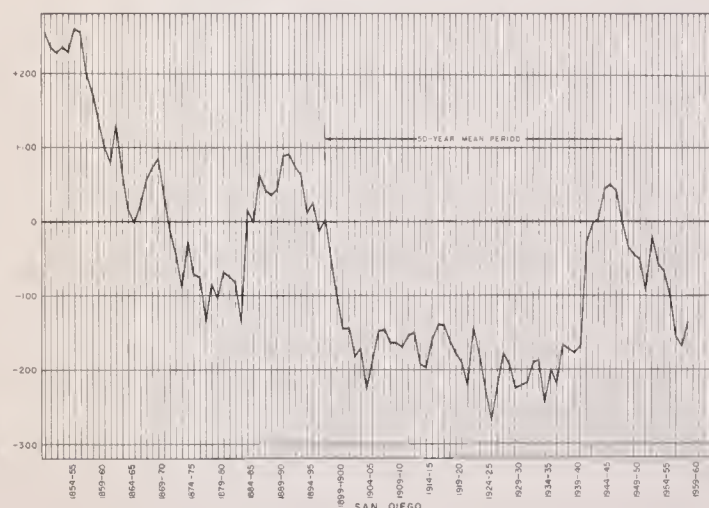
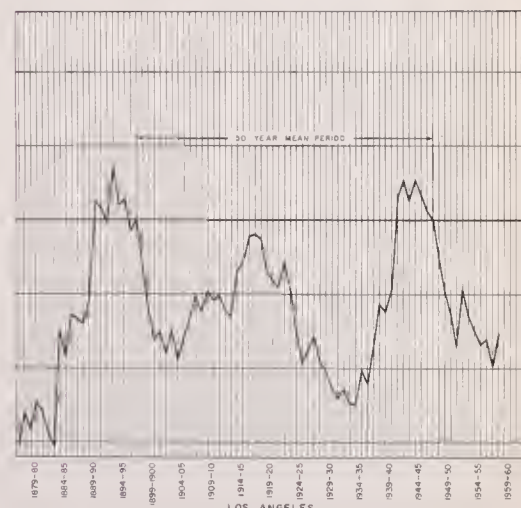
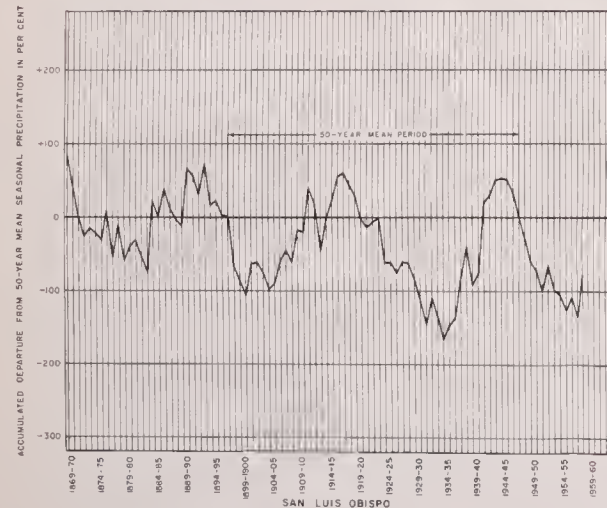
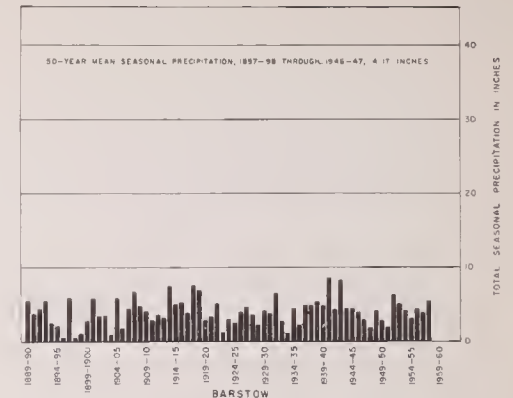
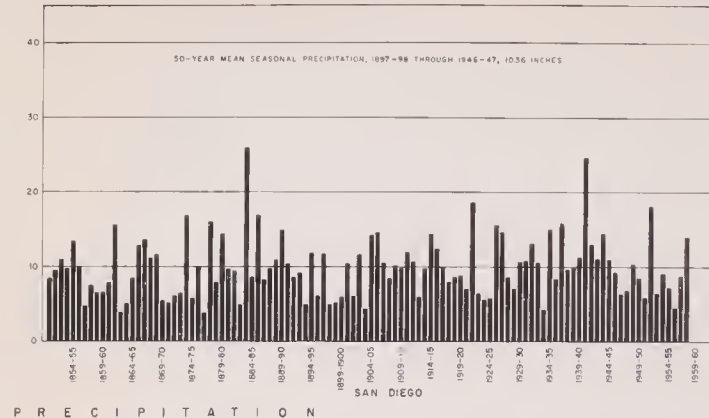
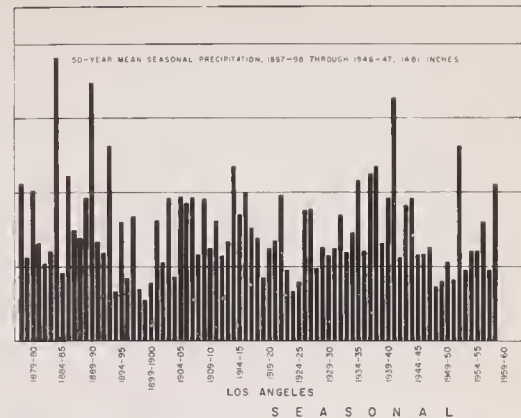
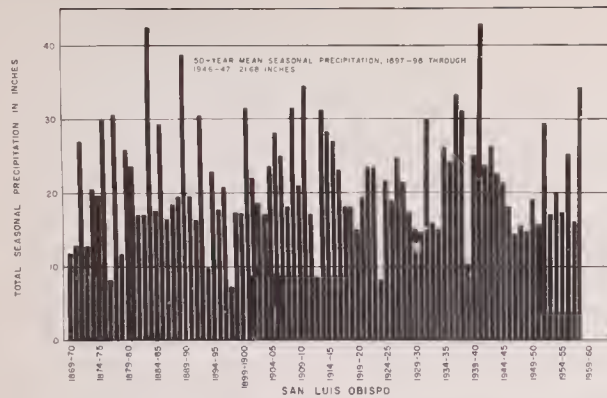
1959-60



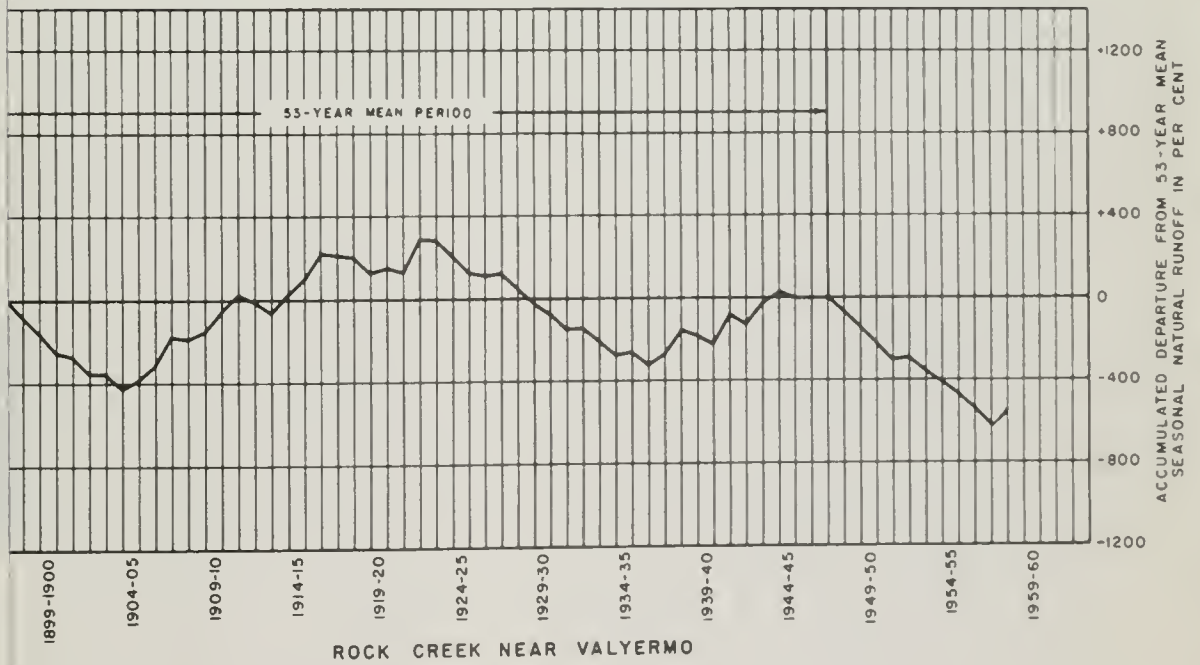
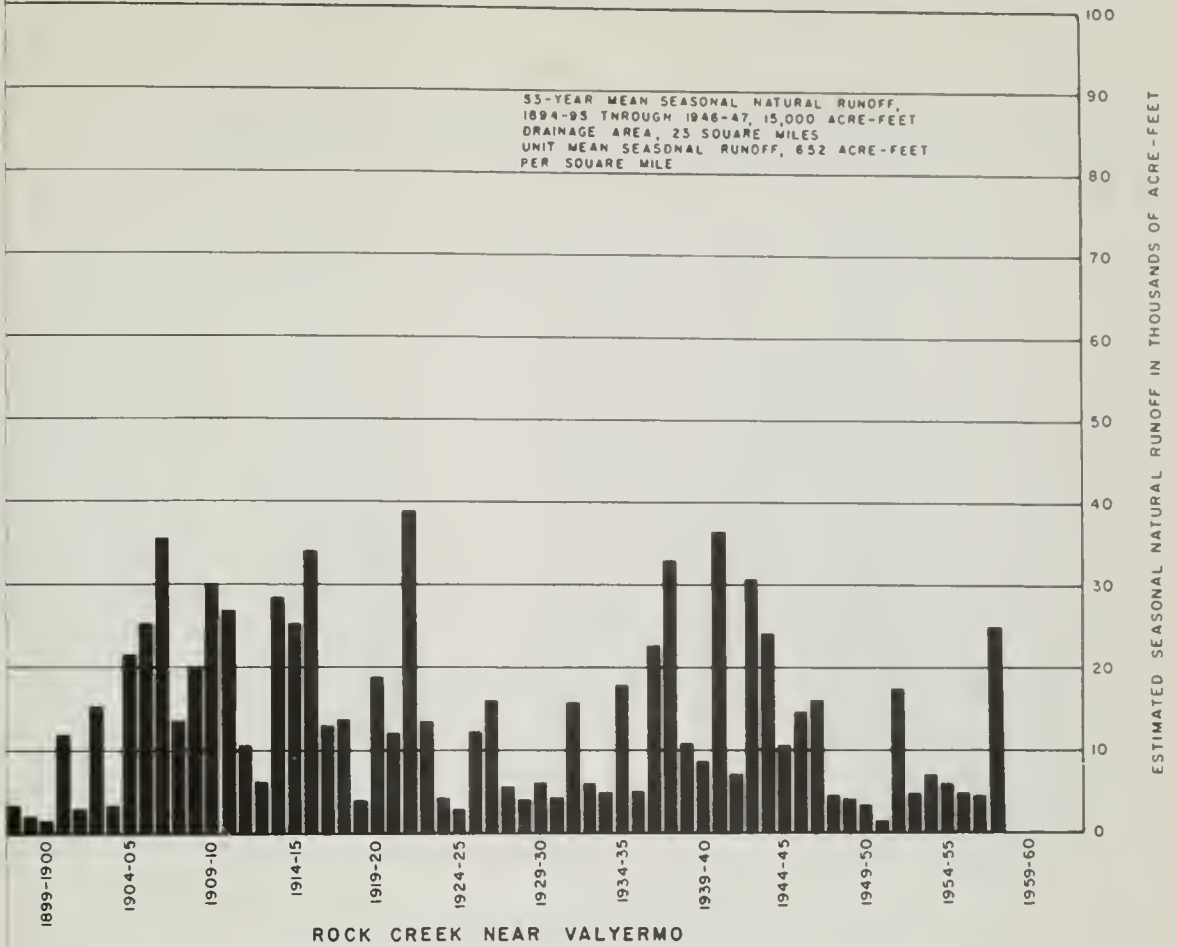
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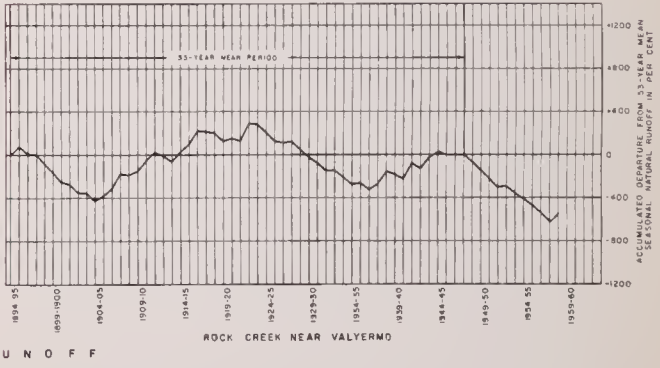
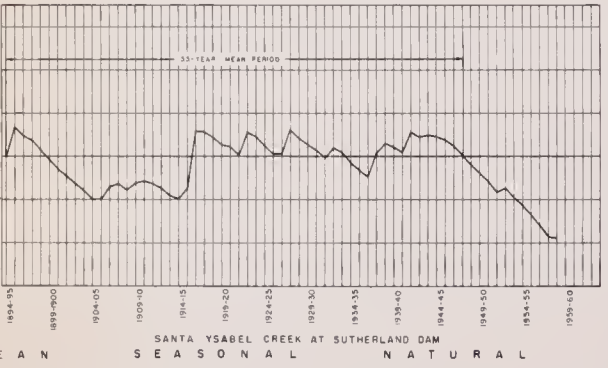
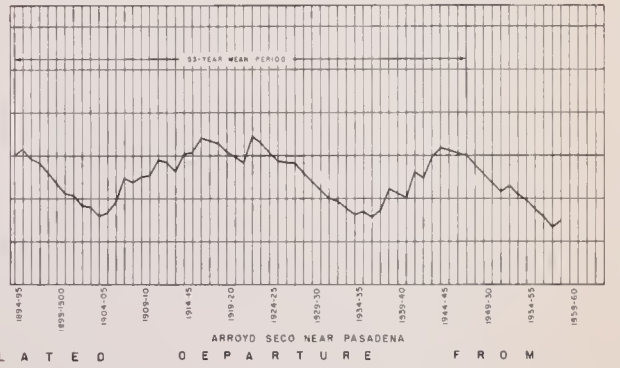
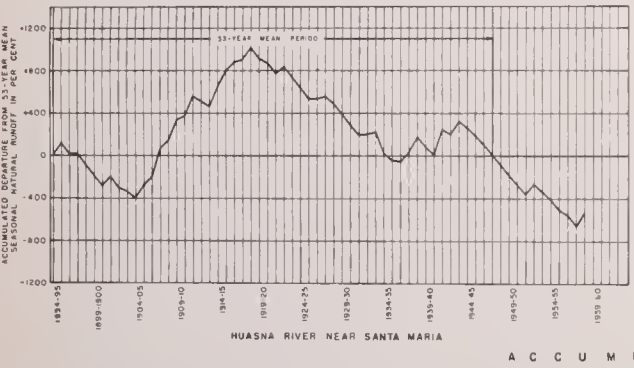
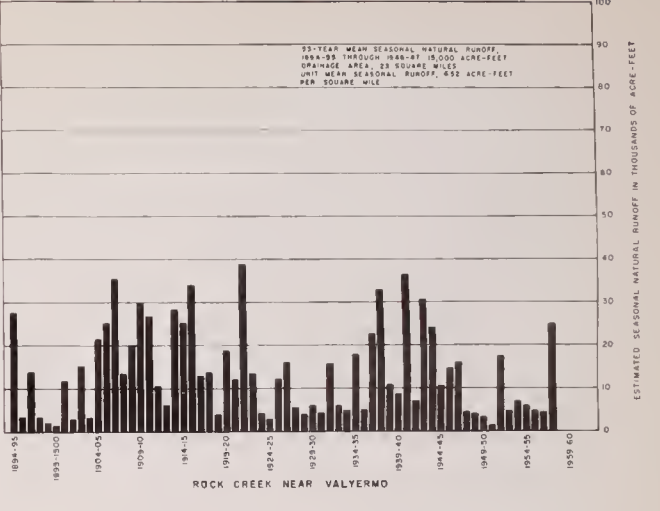
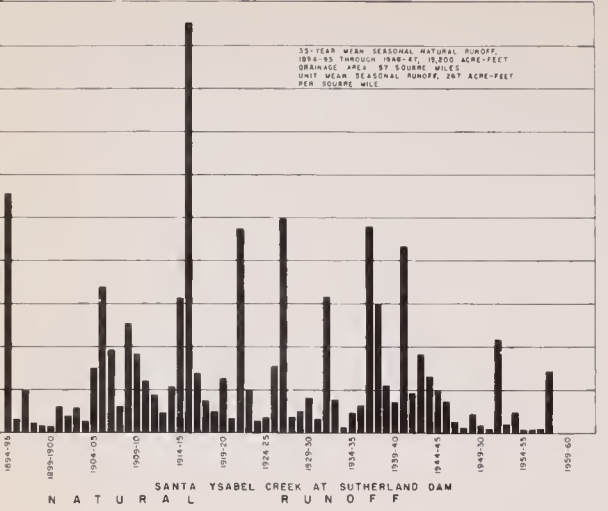
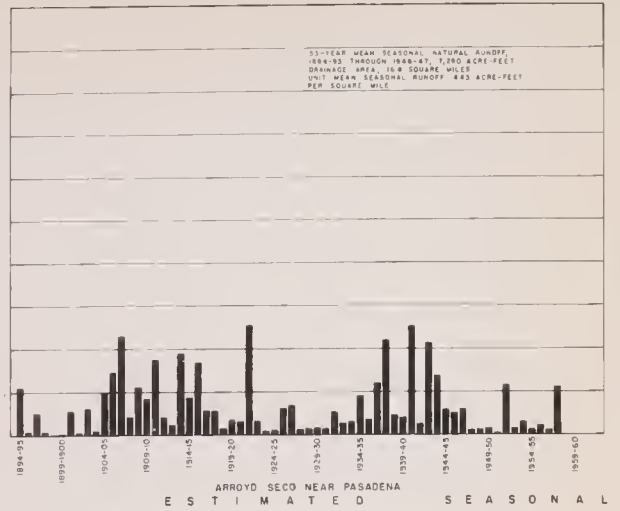
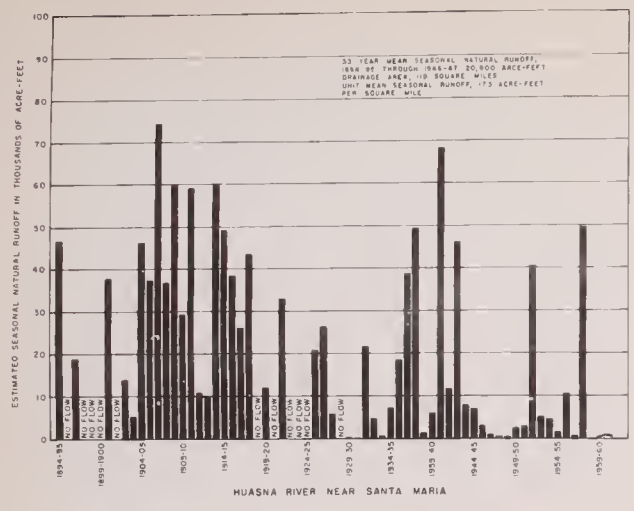
C A L I F O R N I A



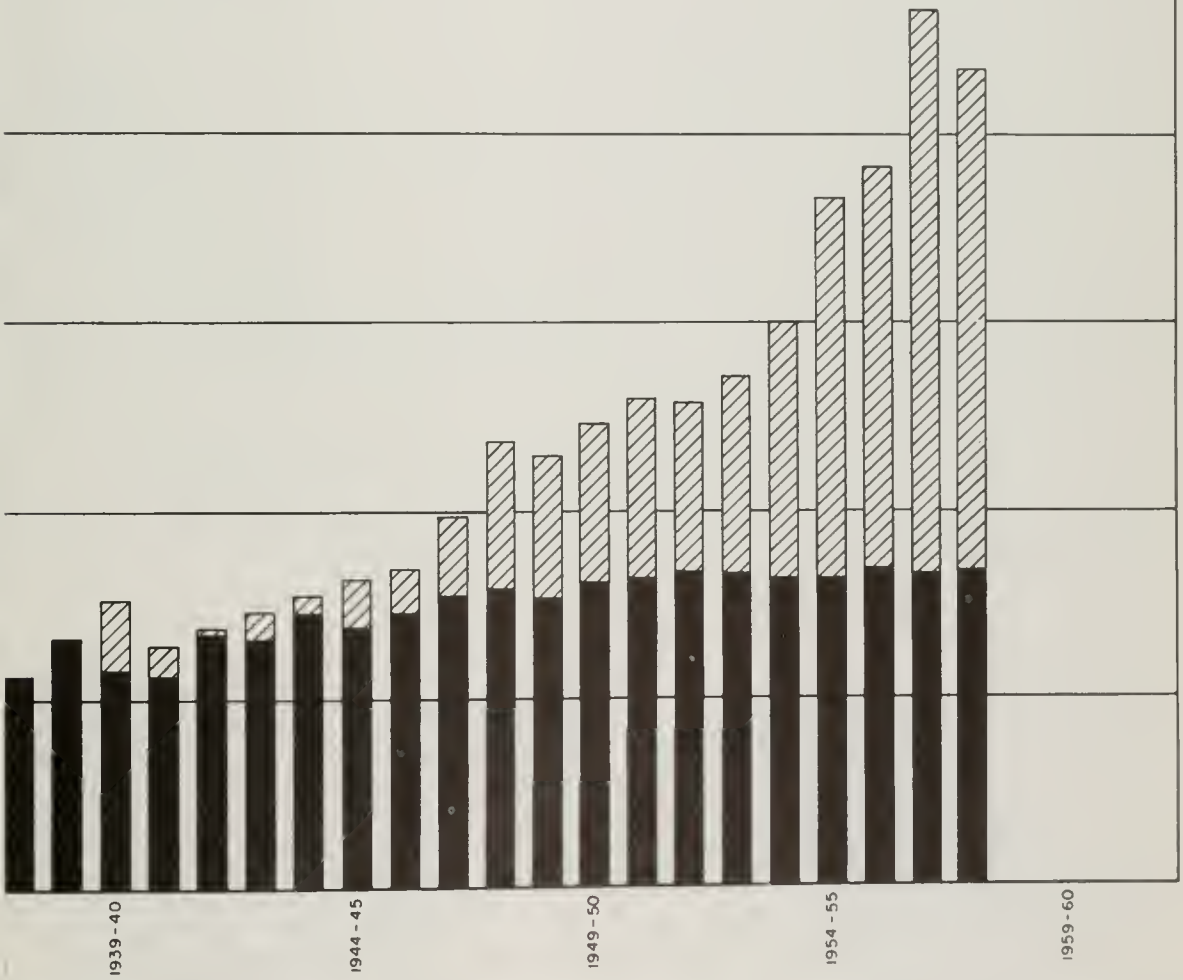
REPRESENTATIVE PRECIPITATION CHARACTERISTICS IN SOUTHERN CALIFORNIA



O F F

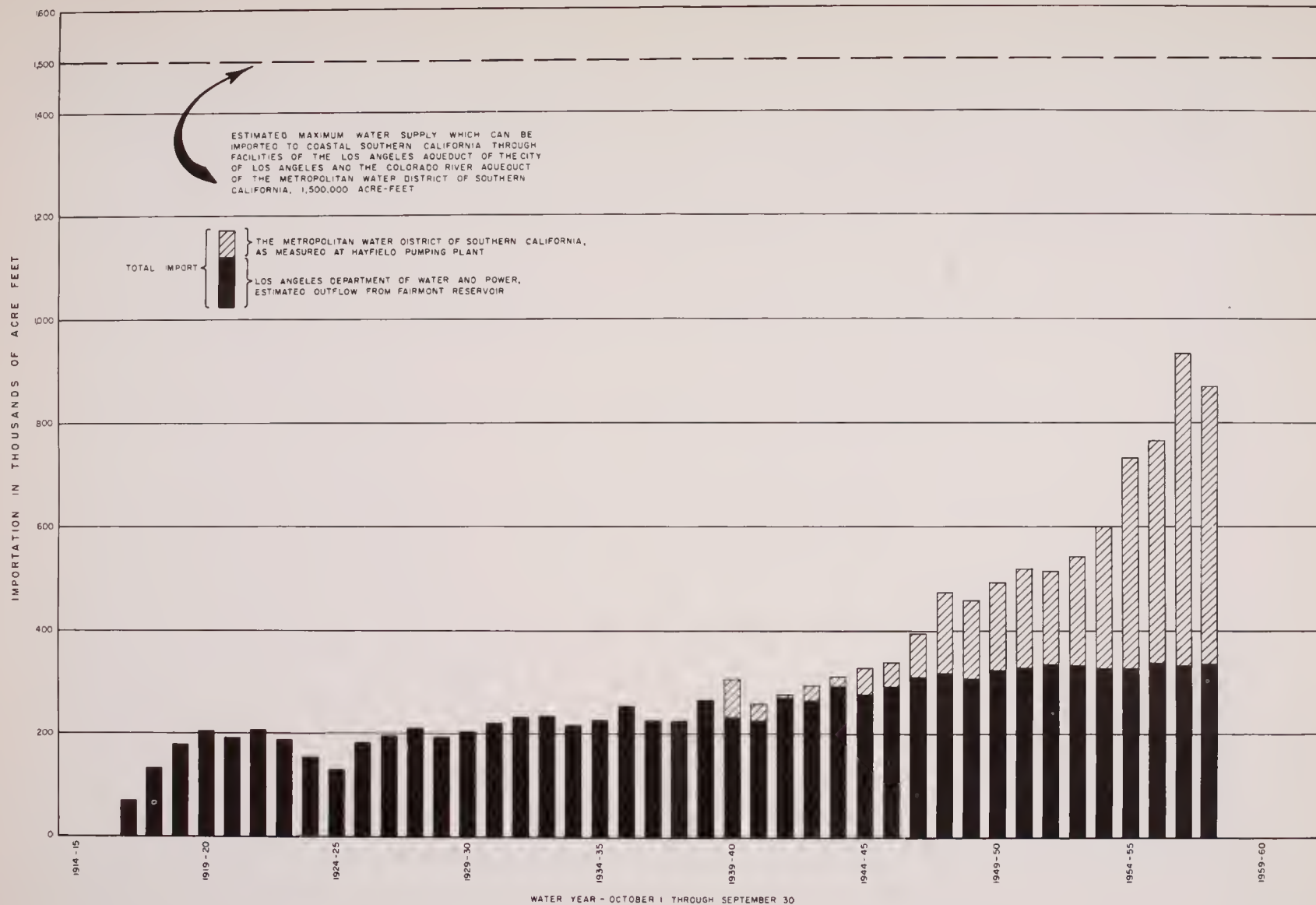


REPRESENTATIVE RUNOFF CHARACTERISTICS IN SOUTHERN CALIFORNIA

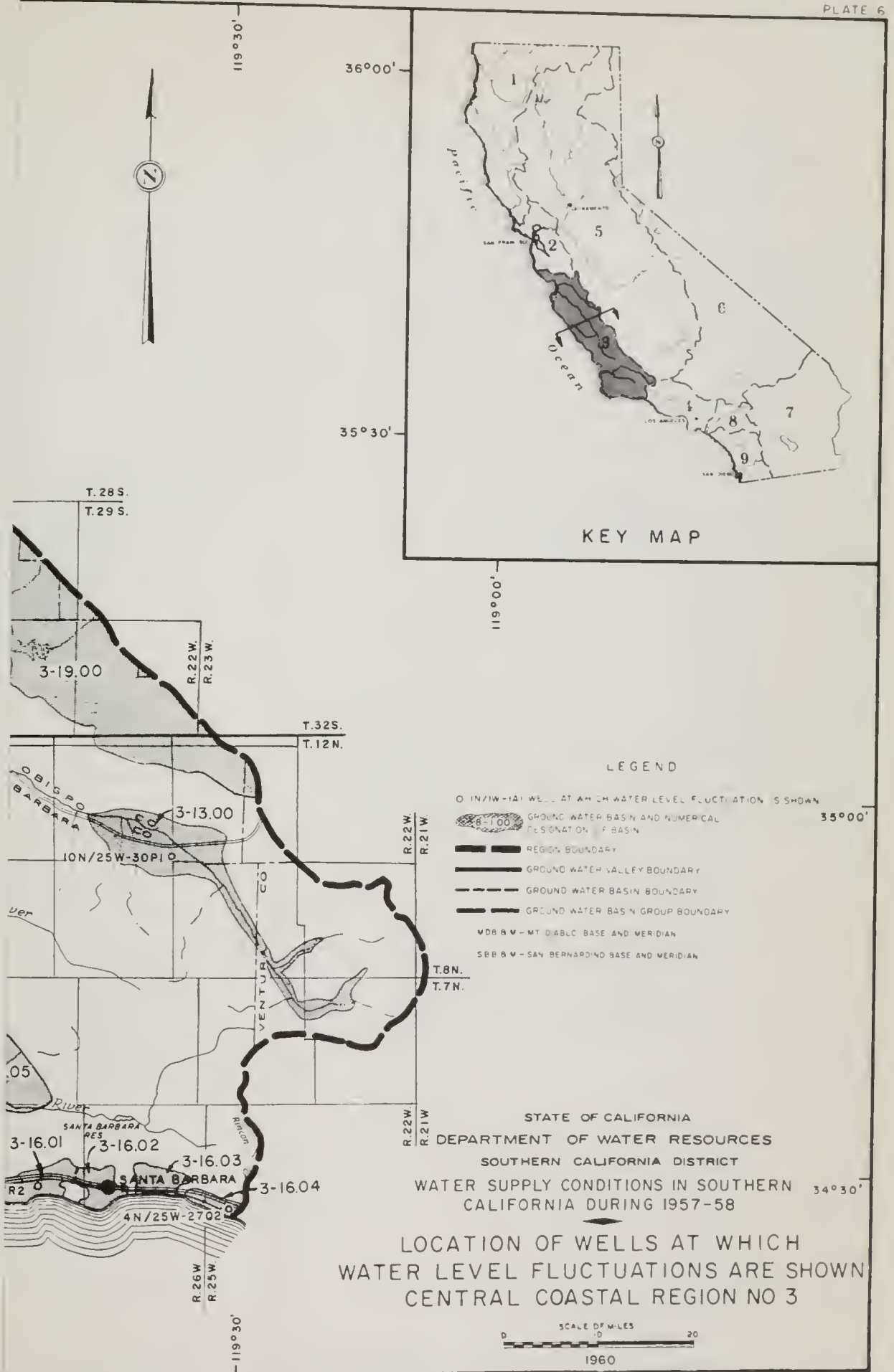


THROUGH SEPTEMBER 30

F WATER TO COASTAL
ALIFORNIA

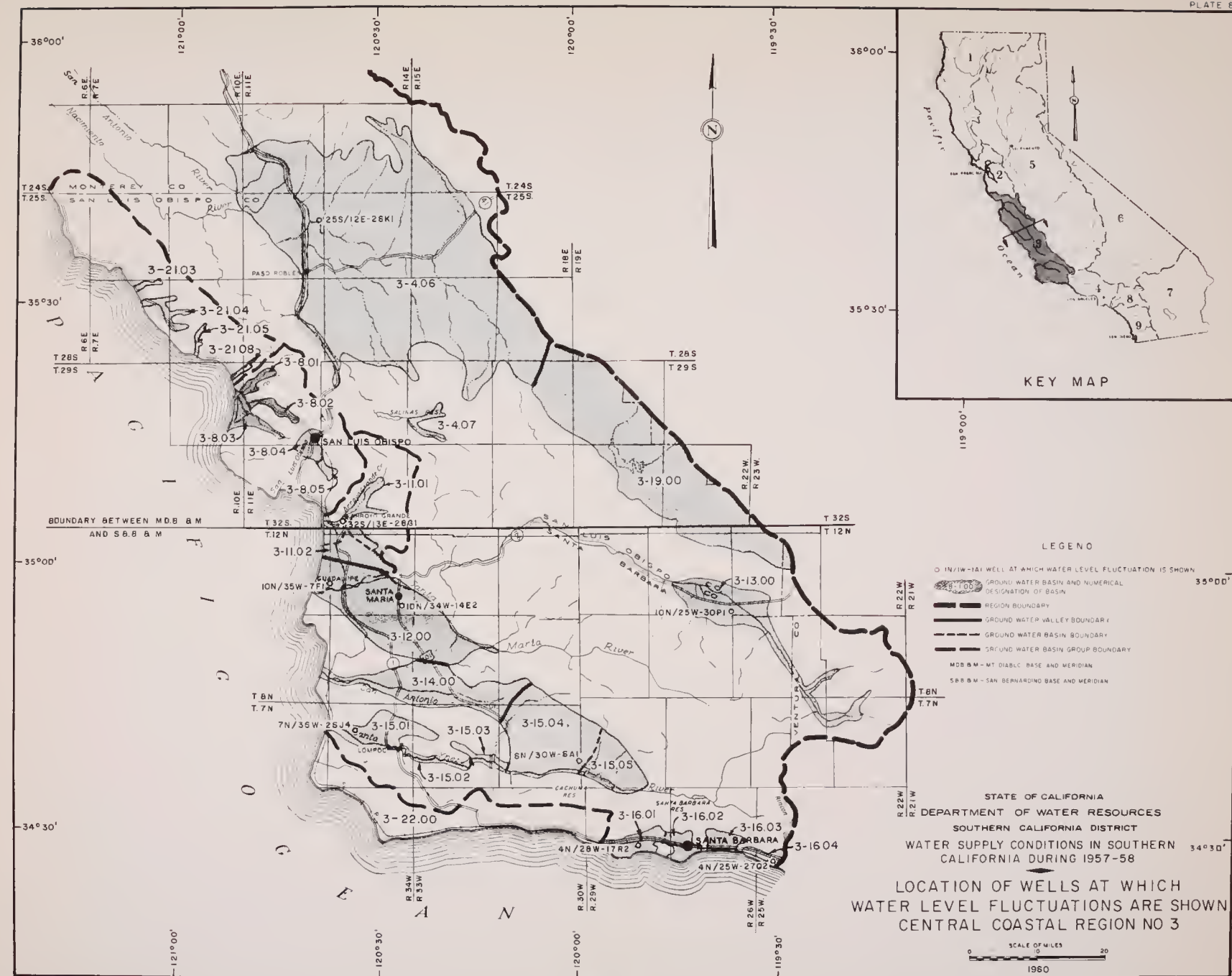


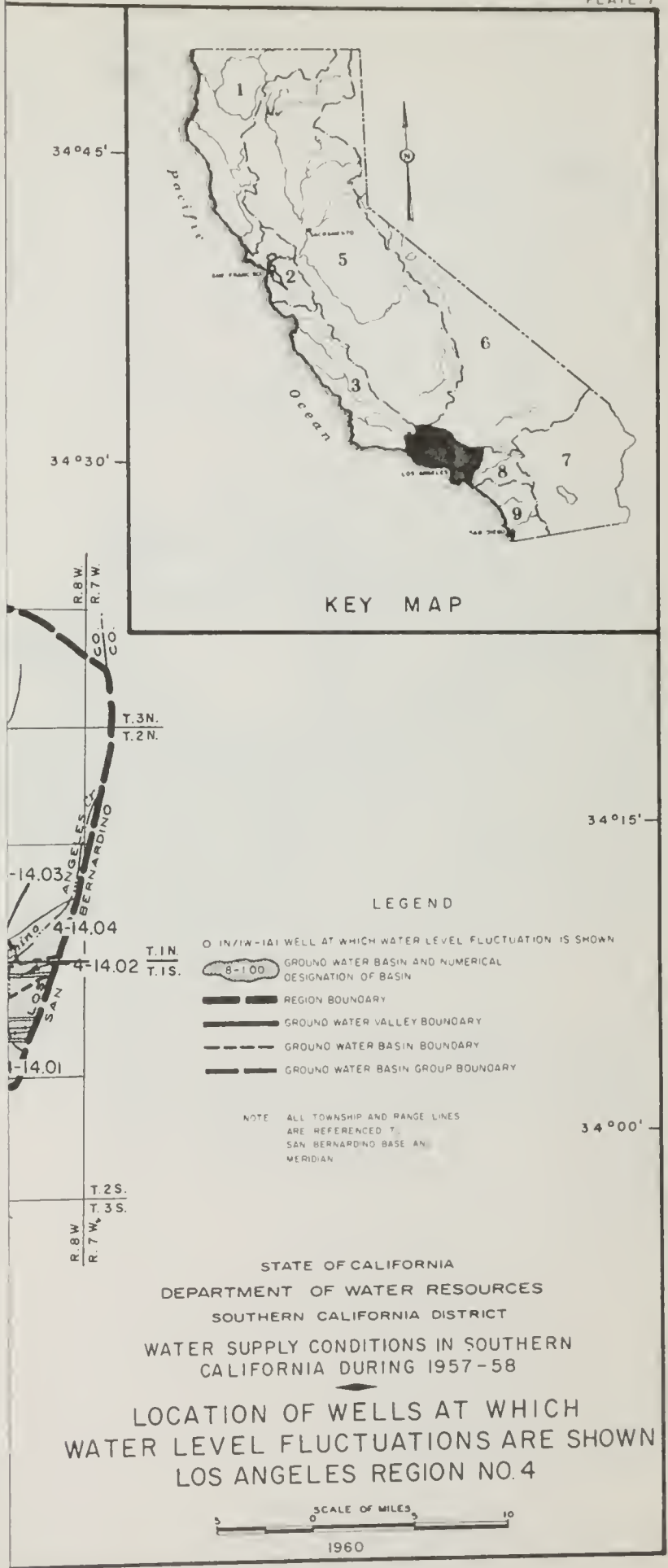
HISTORICAL IMPORTATIONS OF WATER TO COASTAL SOUTHERN CALIFORNIA



NUMERICAL DESIGNATIONS OF
GROUND WATER BASINS

- 3-4.00 Salinas Valley
 - 3-4.06 Paso Robles Basin
 - 3-4.07 Pozo Basin
- 3-8.00 San Luis Obispo Group
 - 3-8.01 Morro Basin
 - 3-8.02 Chorro Basin
 - 3-8.03 Los Osos Basin
 - 3-8.04 San Luis Obispo Basin
 - 3-8.05 Pismo Basin
- 3-11.00 Arroyo Grande Group
 - 3-11.01 Arroyo Grande Basin
 - 3-11.02 Nipomo Mesa Basin
- 3-12.00 Santa Maria River Valley
- 3-13.00 Cuyama River Valley
- 3-14.00 San Antonio Creek Valley
- 3-15.00 Santa Ynez River Valley
 - 3-15.01 Lompoc Subarea
 - 3-15.02 Santa Rita Subarea
 - 3-15.03 Buellton Subarea
 - 3-15.04 Santa Ynez Subarea
 - 3-15.05 Headwater Subarea
- 3-16.00 South Coast Basins (Santa Barbara County)
 - 3-16.01 Goleta Basin
 - 3-16.02 Santa Barbara Basin
 - 3-16.03 Montecito Subarea
 - 3-16.04 Carpinteria Basin
- 3-19.00 Carrizo Plain
- 3-21.00 Cambria Group
 - 3-21.03 San Simeon Basin
 - 3-21.04 Santa Rosa Basin
 - 3-21.05 Villa Basin
 - 3-21.08 Toro Basin
- 3-22.00 Santa Barbara County Coastal Group

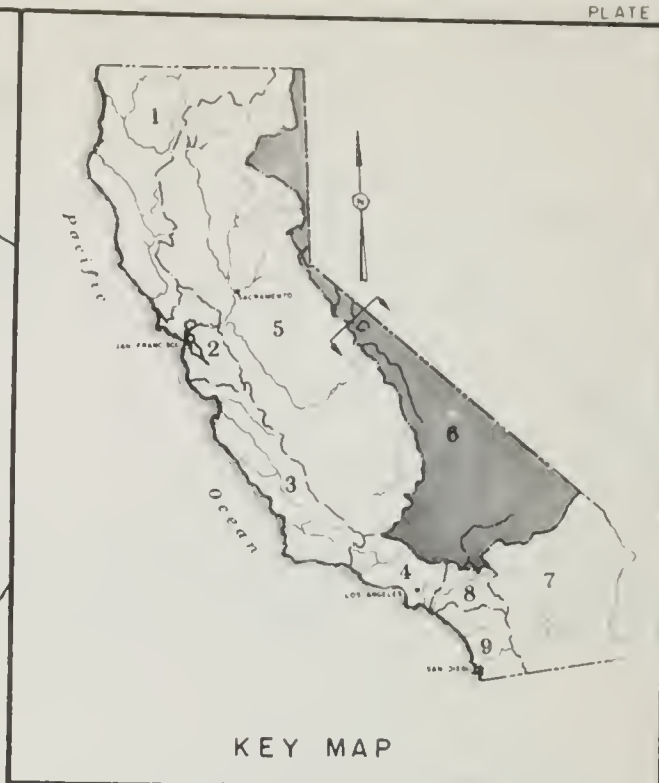




NUMERICAL DESIGNATIONS OF
GROUND WATER BASINS

- 4-1.00 Upper Ojai Valley
- 4-2.00 Ojai Valley
- 4-3.00 Ventura River Valley
 - 4-3.01 Lower Ventura River Basin
 - 4-3.02 Upper Ventura River Basin
- 4-4.00 Santa Clara River Valley
 - 4-4.01 Oxnard Plain Pressure Area
 - 4-4.02 Oxnard Plain Forebay Area
 - 4-4.03 Mound Pressure Area
 - 4-4.04 Santa Paula Basin
 - 4-4.05 Fillmore Basin
 - 4-4.06 Piru Basin
 - 4-4.07 Eastern Basin
- 4-5.00 Acton Valley
- 4-6.00 Pleasant Valley
- 4-7.00 Arroyo Santa Rosa Valley
- 4-8.00 Las Posas Valley
 - 4-8.01 West Las Posas Basin
 - 4-8.02 East Las Posas Basin
- 4-9.00 Simi Valley
- 4-10.00 Conejo Valley
- 4-11.00 Coastal Plain (Los Angeles County)
 - 4-11.01 West Coast Basin North
 - 4-11.02 West Coast Basin
 - 4-11.03 Central Coastal Plain Pressure Area
 - 4-11.04 Los Angeles Forebay Area
 - 4-11.05 Montebello Forebay Area
 - 4-11.06 Hollywood Basin
 - 4-11.07 Los Angeles Narrows Basin
 - 4-11.08 La Habra Basin
- 4-12.00 San Fernando Valley
 - 4-12.01 San Fernando Basin
 - 4-12.02 Bull Canyon Basin
 - 4-12.03 Sylmar Basin
 - 4-12.04 Pacoima Basin
 - 4-12.05 Tujunga Basin
 - 4-12.06 Little Tujunga Basin
 - 4-12.07 Verdugo Basin
- 4-13.00 San Gabriel Valley
 - 4-13.01 Main San Gabriel Basin
 - 4-13.02 Monk Hill Basin
 - 4-13.03 Pasadena Subarea
 - 4-13.04 Santa Anita Subarea
 - 4-13.05 Upper Canyon Basin
 - 4-13.06 Lower Canyon Basin
 - 4-13.07 Glendora Basin
 - 4-13.08 Way Hill Basin
 - 4-13.09 San Dimas Basin
 - 4-13.10 Poothill Basin
 - 4-13.11 Spadra Basin
 - 4-13.12 Puente Basin
- 4-14.00 Upper Santa Ana Valley (Los Angeles County)
 - 4-14.01 Chino Basin
 - 4-14.02 Pomona Basin
 - 4-14.03 Live Oak Basin
 - 4-14.04 Claremont Heights Basin
- 4-15.00 Tierra Rejada Valley
- 4-16.00 Malibu Coastal Group
 - 4-16.01 Hidden Valley Basin
 - 4-16.02 Russell Basin
 - 4-16.03 Arroyo Sequit Canyon Basin
 - 4-16.04 Trancese Canyon Basin
 - 4-16.05 Zuma Canyon Basin
 - 4-16.06 Ramona Canyon Basin
 - 4-16.07 Solstice Canyon Basin
 - 4-16.08 Malibu Creek Basin
 - 4-16.09 Las Flores Canyon Basin
 - 4-16.10 Piedra Gorda Canyon Basin
 - 4-16.11 Las Virgenes Canyon Basin





KEY MAP

LEGEND

O IN/1W-1A1 WELL AT WHICH WATER LEVEL FLUCTUATION IS SHOWN

8-100 GROUND WATER BASIN AND NUMERICAL DESIGNATION OF BASIN

REGION BOUNDARY

GROUND WATER VALLEY BOUNDARY

GROUND WATER BASIN BOUNDARY

SBB BM - SAN BERNARDINO BASE AND MERIDIAN

MDB BM - MT. DIABLO BASE AND MERIDIAN

SAN BERNARDINO MERIDIAN

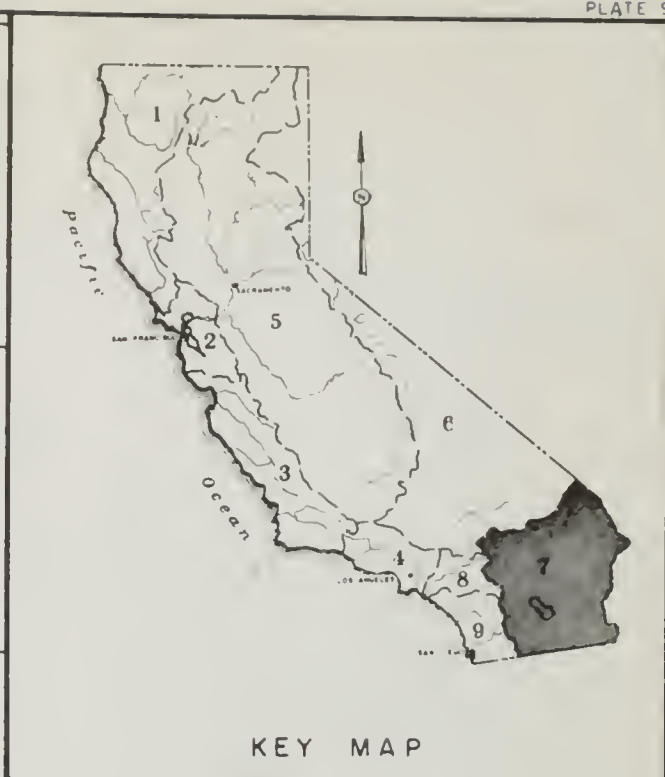
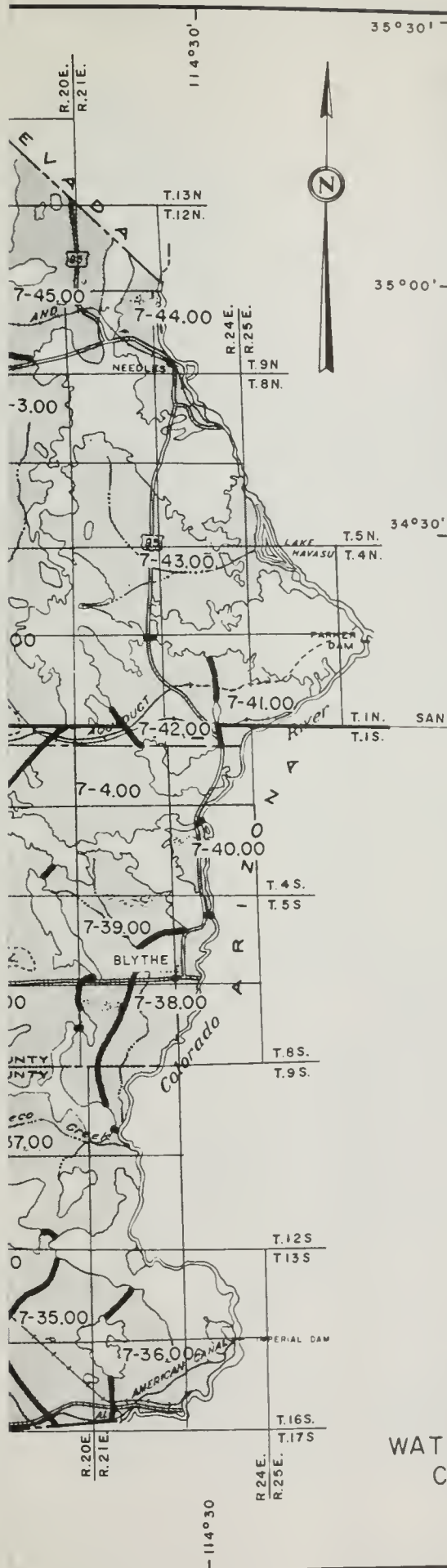
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
SOUTHERN CALIFORNIA DISTRICT
WATER SUPPLY CONDITIONS IN SOUTHERN
CALIFORNIA DURING 1957-58

LOCATION OF WELLS AT WHICH
WATER LEVEL FLUCTUATIONS ARE SHOWN
LAHONTAN REGION NO. 6

SCALE OF MILES
10 0 10 20
1960

- | | |
|---------|----------------------------|
| 6-9.00 | Monro Valley |
| 6-10.00 | Adobe Lake Valley |
| 6-11.00 | Long Valley |
| 6-12.00 | Owens Valley |
| 6-13.00 | Black Springs Valley |
| 6-14.00 | Fish Lake Valley |
| 6-15.00 | Deep Springs Valley |
| 6-16.00 | Eureka Valley |
| 6-17.00 | Saline Valley |
| 6-18.00 | Death Valley |
| 6-19.00 | Wingate Valley |
| 6-20.00 | Mt. Amargosa Valley |
| 6-21.00 | Lower Kingston Valley |
| 6-22.00 | Upper Kingston Valley |
| 6-23.00 | Riggs Valley |
| 6-24.00 | Red Pass Valley |
| 6-25.00 | Bicycle Valley |
| 6-26.00 | Awatatz Valley |
| 6-27.00 | Leach Valley |
| 6-28.00 | Pahrump Valley |
| 6-29.00 | Mesquite Valley |
| 6-30.00 | Ivanpah Valley |
| 6-31.00 | Kelso Valley |
| 6-32.00 | Broadwell Valley |
| 6-33.00 | Soda Lake Valley |
| 6-34.00 | Silver Lake Valley |
| 6-35.00 | Cronise Valley |
| 6-36.00 | Langford Valley |
| 6-37.00 | Coyote Lake Valley |
| 6-38.00 | Caves Canyon Valley |
| 6-39.00 | Troy Valley |
| 6-40.00 | Lower Mojave River Valley |
| 6-41.00 | Middle Mojave River Valley |
| 6-42.00 | Upper Mojave River Valley |
| 6-43.00 | El Mirage Valley |
| 6-44.00 | Antelope Valley |
| 6-44.01 | Neenach Basin |
| 6-44.02 | Willow Springs Basin |
| 6-44.03 | Gloster Basin |
| 6-44.04 | Chaffee Basin |
| 6-44.05 | Lancaster Basin |
| 6-44.06 | Buttes Basin |
| 6-44.07 | Crook Creek Basin |
| 6-44.08 | North Muroc Basin |
| 6-45.00 | Tehachapi Valley East |
| 6-46.00 | Freemont Valley |
| 6-47.00 | Harper Valley |
| 6-48.00 | Goldstone Valley |
| 6-49.00 | Superior Valley |
| 6-50.00 | Cuddeback Valley |
| 6-51.00 | Pilot Knob Valley |
| 6-52.00 | Searles Valley |
| 6-53.00 | Salt Wells Valley |
| 6-54.00 | Indian Wells Valley |
| 6-55.00 | Coso Valley |
| 6-56.00 | Rose Valley |
| 6-57.00 | Darwin Valley |
| 6-58.00 | Panamint Valley |





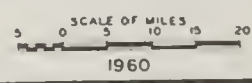
KEY MAP

LEGEND

- O IN/1W-1A) WELL AT WHICH WATER LEVEL FLUCTUATION IS SHOWN
- 8-100 GROUND WATER BASIN AND NUMERICAL DESIGNATION OF BASIN
- REGION BOUNDARY
- GROUND WATER VALLEY BOUNDARY
- GROUND WATER BASIN BOUNDARY

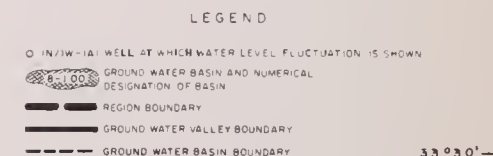
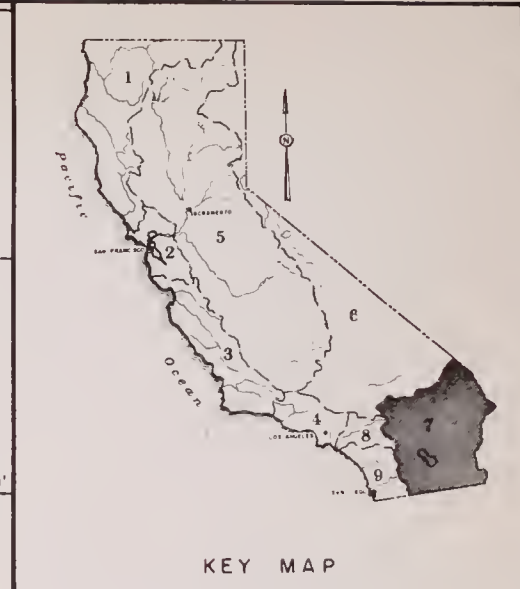
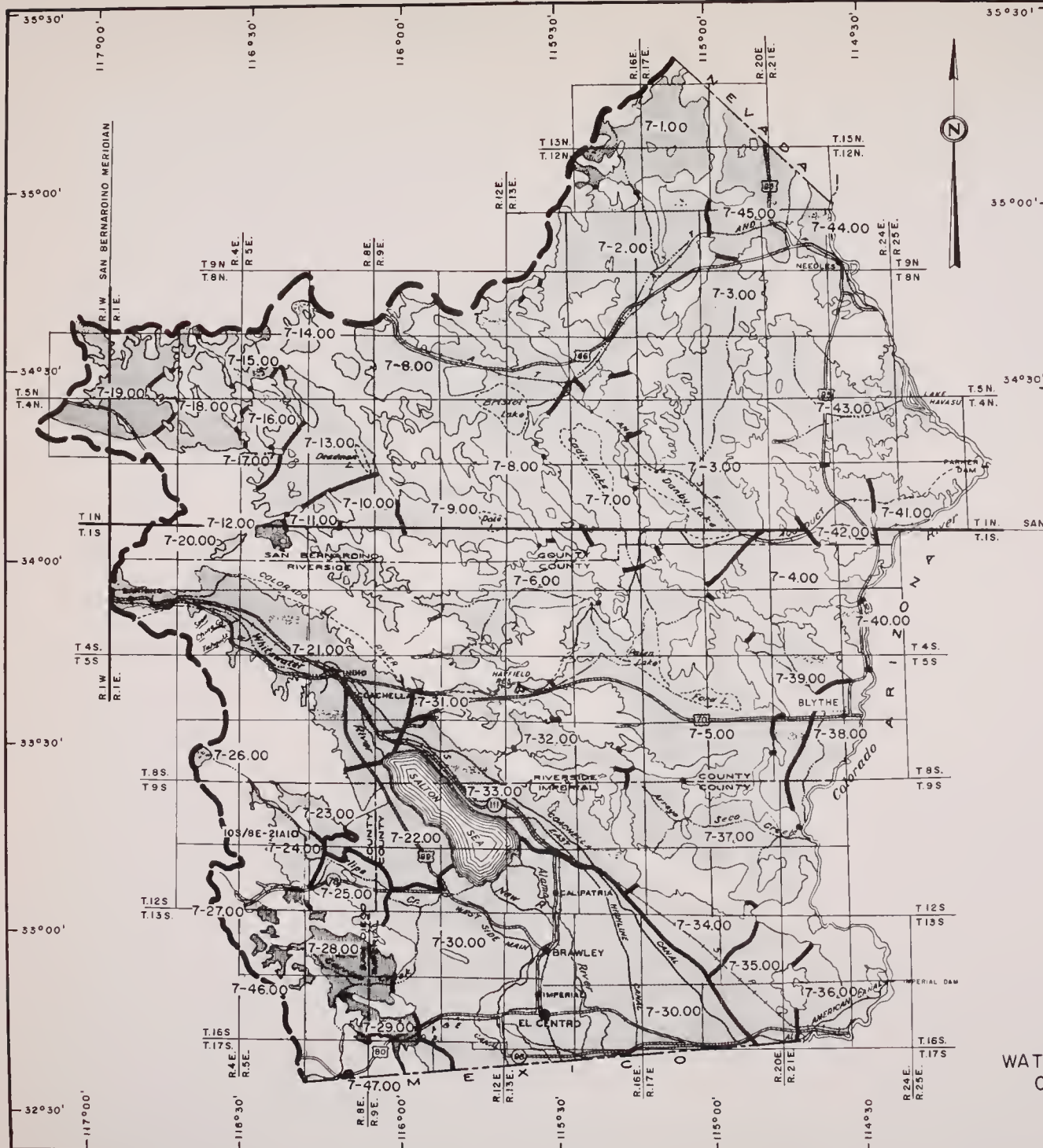
NOTE ALL TOWNSHIP AND RANGE LINES ARE REFERENCED TO SAN BERNARDINO BASE AND MERIDIAN

STATE OF CALIFORNIA
 DEPARTMENT OF WATER RESOURCES
 SOUTHERN CALIFORNIA DISTRICT
 WATER SUPPLY CONDITIONS IN SOUTHERN CALIFORNIA DURING 1957-58
 LOCATION OF WELLS AT WHICH WATER LEVEL FLUCTUATIONS ARE SHOWN
 COLORADO RIVER BASIN REGION NO 7



NUMERICAL DESIGNATIONS OF
GROUND WATER BASINS

- 7-1.00 Lanfair Valley
- 7-2.00 Penner Valley
- 7-3.00 Ward Valley
- 7-4.00 Rice Valley
- 7-5.00 Chuckawalla Valley
- 7-6.00 Pinto Valley
- 7-7.00 Cadiz Valley
- 7-8.00 Bristol Valley
- 7-9.00 Dale Valley
- 7-10.00 Twentynine Palms Valley
- 7-11.00 Copper Mountain Valley
- 7-12.00 Warren Valley
- 7-13.00 Deadman Valley
- 7-14.00 Lavic Valley
- 7-15.00 Bessemer Valley
- 7-16.00 Ames Valley
- 7-17.00 Means Valley
- 7-18.00 Johnson Valley
- 7-19.00 Lucerne Valley
- 7-20.00 Morongo Valley
- 7-21.00 Coachella Valley
- 7-22.00 West Salton Sea Valley
- 7-23.00 Clark Valley
- 7-24.00 Borrego Valley
- 7-25.00 Ocotillo Valley
- 7-26.00 Terwilliger Valley
- 7-27.00 San Felipe Valley
- 7-28.00 Vallecito-Carrizo Valley
- 7-29.00 Coyote Wells Valley
- 7-30.00 Imperial Valley
- 7-31.00 Orcopia Valley
- 7-32.00 Chocolate Valley
- 7-33.00 East Salton Sea Valley
- 7-34.00 Amos Valley
- 7-35.00 Ogilby Valley
- 7-36.00 Yuma Valley
- 7-37.00 Arroyo Seco Valley
- 7-38.00 Palo Verde Valley
- 7-39.00 Palo Verde Mesa
- 7-40.00 Quien Sabe Point Valley
- 7-41.00 Calzona Valley
- 7-42.00 Vidal Valley
- 7-43.00 Chemehuevis Valley
- 7-44.00 Needles Valley
- 7-45.00 Piute Valley
- 7-46.00 Canebrake Valley
- 7-47.00 Jacumba Valley

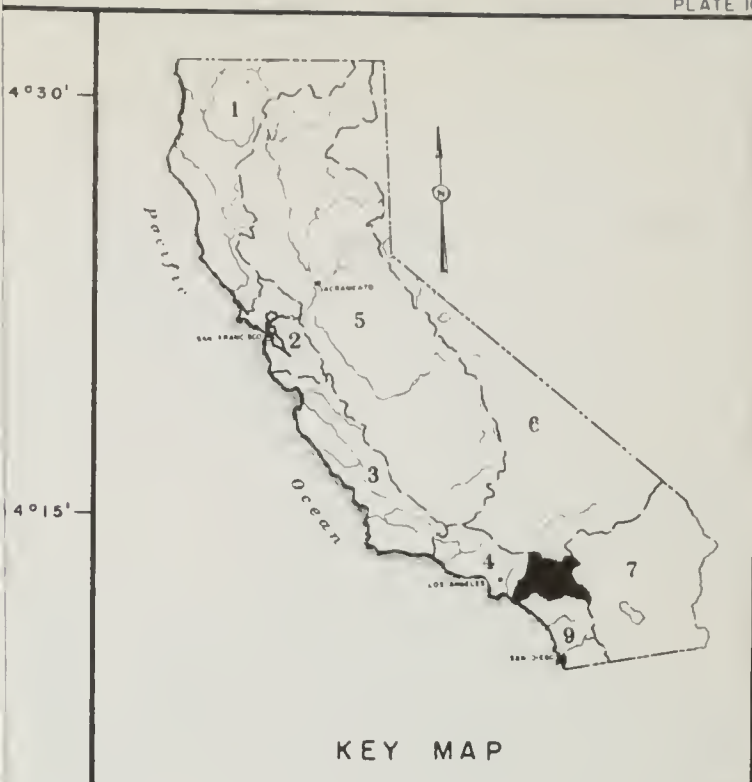


NOTE ALL TOWNSHIP AND RANGE LINES ARE REFERENCED TO SAN BERNARDINO BASE AND MERIDIAN

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
SOUTHERN CALIFORNIA DISTRICT
WATER SUPPLY CONDITIONS IN SOUTHERN CALIFORNIA DURING 1957-58

LOCATION OF WELLS AT WHICH WATER LEVEL FLUCTUATIONS ARE SHOWN
COLORADO RIVER BASIN REGION NO. 7

SCALE OF MILES
0 5 10 15 20
1960



34°00'

LEGEND

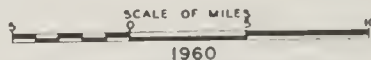
- O IN/1W-1A1 WELL AT WHICH WATER LEVEL FLUCTUATION IS SHOWN
- GROUND WATER BASIN AND NUMERICAL DESIGNATION OF BASIN
- REGION BOUNDARY
- GROUND WATER VALLEY BOUNDARY
- GROUND WATER BASIN BOUNDARY

NOTE ALL TOWNSHIP AND RANGE LINES
ARE REFERENCED TO
SAN BERNARDINO BASE AND
MERIDIAN

33°45'

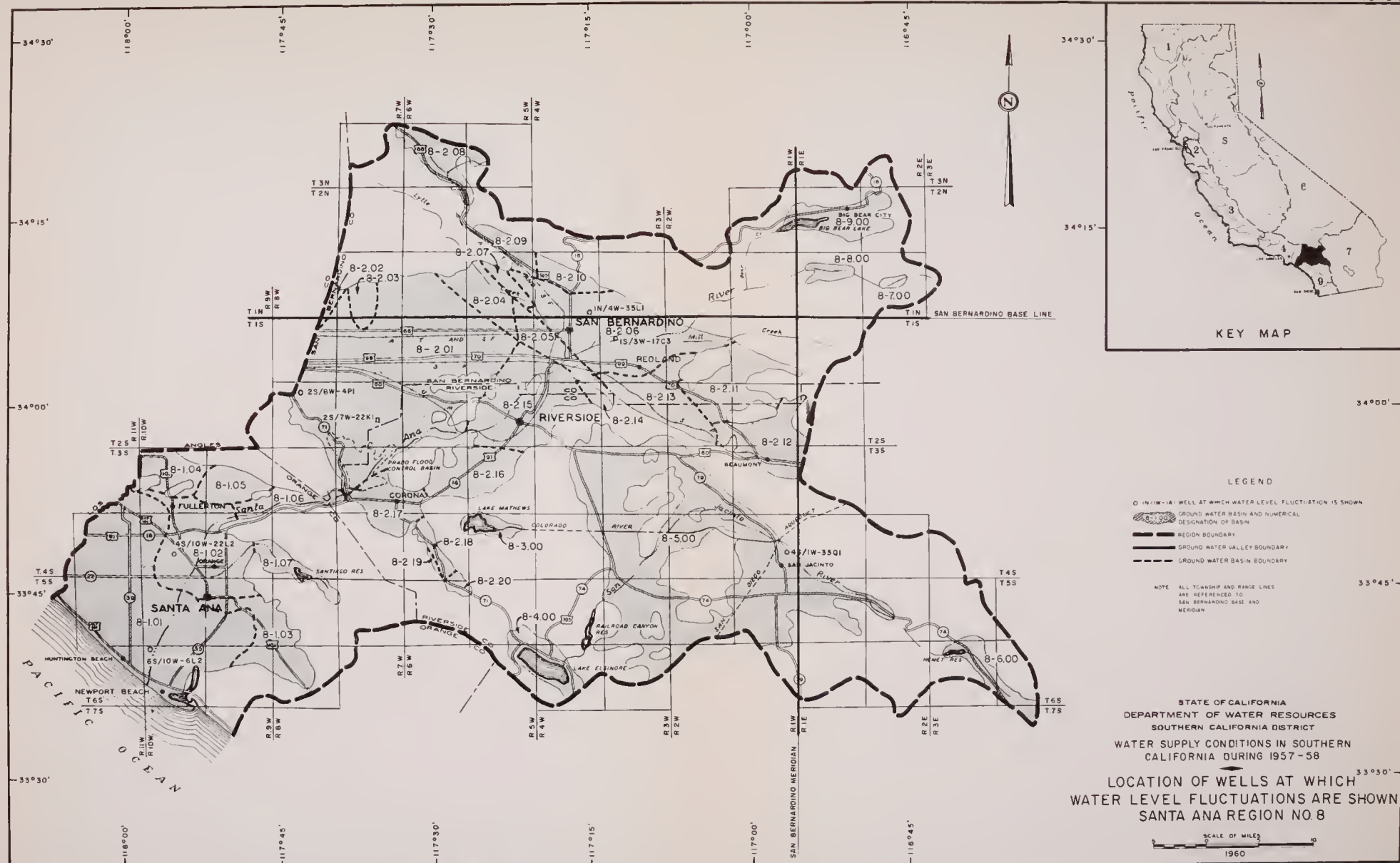
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
SOUTHERN CALIFORNIA DISTRICT
WATER SUPPLY CONDITIONS IN SOUTHERN
CALIFORNIA DURING 1957-58
LOCATION OF WELLS AT WHICH
WATER LEVEL FLUCTUATIONS ARE SHOWN
SANTA ANA REGION NO. 8

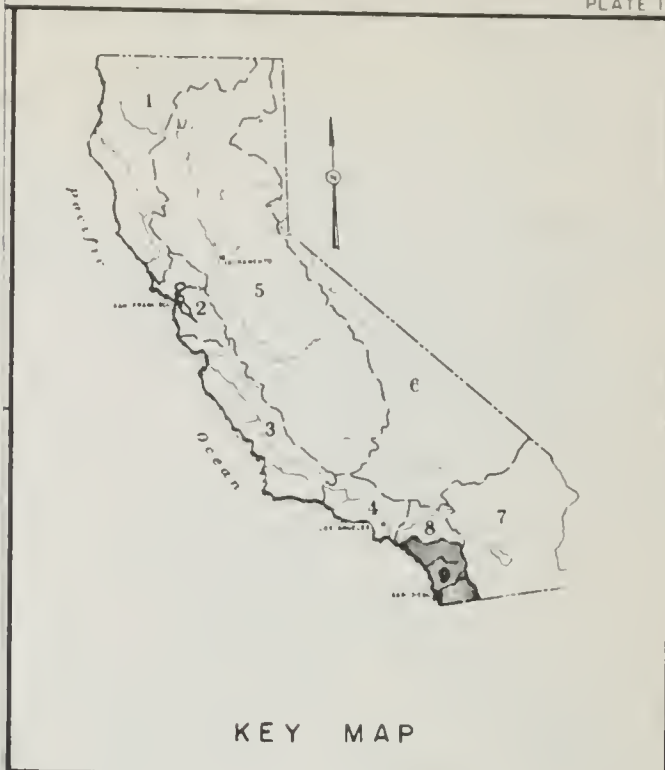
33°30'



NUMERICAL DESIGNATIONS OF
GROUND WATER BASINS

- | | |
|--------|----------------------------------|
| 8-1.00 | Coastal Plain (Orange County) |
| 8-1.01 | East Coastal Plain Pressure Area |
| 8-1.02 | Santa Ana Forebay Area |
| 8-1.03 | Irvine Basin |
| 8-1.04 | La Habra Basin |
| 8-1.05 | Yarba Linda Basin |
| 8-1.06 | Santa Ana Narrows Basin |
| 8-1.07 | Santiago Basin |
| 8-2.00 | Upper Santa Ana Valley |
| 8-2.01 | Chino Basin |
| 8-2.02 | Claremont Heights Basin |
| 8-2.03 | Cucamonga Basin |
| 8-2.04 | Rialto Basin |
| 8-2.05 | Colton Basin |
| 8-2.06 | Bunker Hill Basin |
| 8-2.07 | Lytle Basin |
| 8-2.08 | Upper Cajon Basin |
| 8-2.09 | Lower Cajon Basin |
| 8-2.10 | Devil Canyon Basin |
| 8-2.11 | Yucaipa Basin |
| 8-2.12 | Beaumont Basin |
| 8-2.13 | San Timoteo Basin |
| 8-2.14 | Reche Canyon Basin |
| 8-2.15 | Riverside Basin |
| 8-2.16 | Arlington Basin |
| 8-2.17 | Temescal Basin |
| 8-2.18 | Bedford Basin |
| 8-2.19 | Coldwater Basin |
| 8-2.20 | Lee Lake Basin |
| 8-3.00 | Cajalco Valley |
| 8-4.00 | Elsinore Valley |
| 8-5.00 | San Jacinto Valley |
| 8-6.00 | Hemet Lake Valley |
| 8-7.00 | Big Meadows Valley |
| 8-8.00 | Seven Oaks Valley |
| 8-9.00 | Bear Valley |





33°15'

LEGEND

O IN/1W-1A WELL AT WHICH WATER LEVEL FLUCTUATION IS SHOWN



GROUND WATER BASIN AND NUMERICAL DESIGNATION OF BASIN

33°00'



REGION BOUNDARY



GROUND WATER VALLEY BOUNDARY



GROUND WATER BASIN BOUNDARY

NOTE ALL TOWNSHIP AND RANGE LINES ARE REFERENCED TO SAN BERNARDINO BASE AND MERIDIAN

32°45'

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
SOUTHERN CALIFORNIA DISTRICT

WATER SUPPLY CONDITIONS IN SOUTHERN CALIFORNIA DURING 1957-58

LOCATION OF WELLS AT WHICH WATER LEVEL FLUCTUATIONS ARE SHOWN
SAN DIEGO REGION NO 9

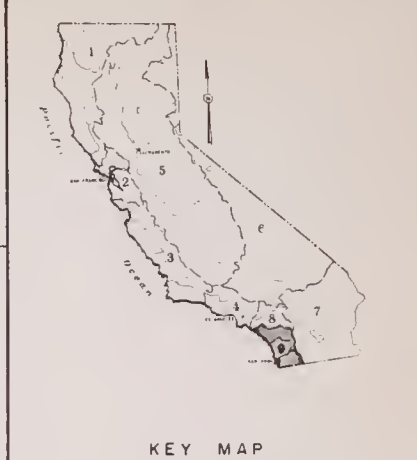


1960

32°30'

NUMERICAL DESIGNATIONS OF GROUND WATER BASINS

- 9-1.00 San Juan Valley
- 9-1.01 Aliso Creek Basin
- 9-1.02 San Juan Creek Basin
- 9-2.00 San Mateo Valley
- 9-3.00 San Onofre Valley
- 9-4.00 Santa Margarita Valley
- 9-5.00 Temecula Valley
- 9-5.01 Murrieta Basin
- 9-5.02 Pauba Basin
- 9-5.03 Wolf Basin (Pechanga)
- 9-6.00 Coahuila Valley
- 9-7.00 San Luis Rey Valley
- 9-7.01 Mission Basin
- 9-7.02 Bonsall Basin
- 9-8.00 Warner Valley
- 9-9.00 Escondido Valley
- 9-10.00 San Pasqual Valley
- 9-10.01 Lake Hodges Basin
- 9-10.02 San Pasqual Basin
- 9-10.03 Felicita Basin
- 9-10.04 Green Basin
- 9-10.05 Highland Basin
- 9-10.06 Pamo Basin
- 9-10.08 Santa Ysabel Basin
- 9-11.00 Santa Maria Valley
- 9-11.01 Ramona Basin
- 9-11.02 Lower Hatfield Basin
- 9-11.03 Wash Hollow Basin
- 9-11.04 Upper Hatfield Basin
- 9-11.05 Santa Teresa Basin
- 9-11.06 Bellena Basin
- 9-12.00 San Dieguito Valley
- 9-12.01 San Dieguito Basin
- 9-12.02 La Jolla Basin
- 9-13.00 Powey Valley
- 9-14.00 Mission Valley
- 9-15.00 San Diego River Valley
- 9-16.00 El Cajon Valley
- 9-17.00 Sweetwater Valley
- 9-18.00 Otay Valley
- 9-19.00 Tie Juana Valley
- 9-20.00 Jamul Valley



LEGEND

IN 1/4-1/2 MI. BY WHICH WATER LEVEL ELEVATION IS SHOWN

GROUND WATER BASIN AND NUMERICAL DESIGNATION OF BASIN

REGION BOUNDARY

GROUND WATER VALLEY BOUNDARY

GROUND WATER BASIN BOUNDARY

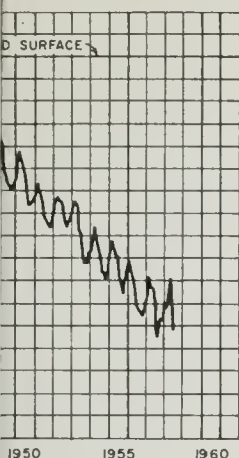
NOTE: ALL TOWNSHIP AND RANGE LINES ARE REFERENCED TO SAN BERNARDINO BASE AND MERIDIAN

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
SOUTHERN CALIFORNIA DISTRICT
WATER SUPPLY CONDITIONS IN SOUTHERN CALIFORNIA DURING 1957-58

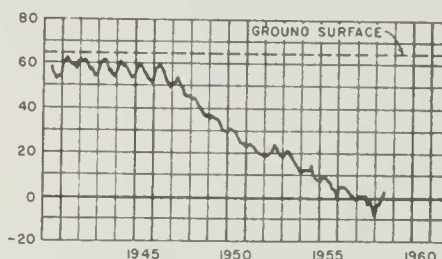
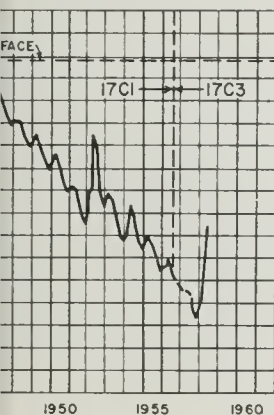
LOCATION OF WELLS AT WHICH WATER LEVEL FLUCTUATIONS ARE SHOWN
SAN DIEGO REGION NO 9

SCALE OF MILES
0 10 20
1960

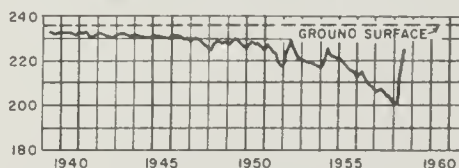
TEMECULA VALLEY (9-5.00)
MURRIETA BASIN (9-5.01)
WELLS 7S 3W-17P4, 17P5, S B B. & M.



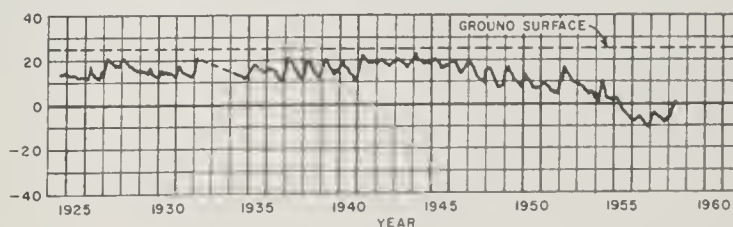
SAN LUIS REY VALLEY (9-7.00)
MISSION BASIN (9-7.01)
WELL 11S/4W-9E1, S.B.B. & M.



BONSALL BASIN (9-7.02)
WELL 10S/3W-11G1, S.B.B. & M.



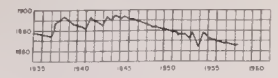
TIA JUANA VALLEY (9-19.00)
WELL 19S/2W-4A13, S.B.B. & M.



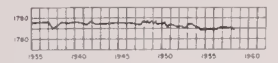
FLUCTUATION OF WATER LEVELS
AT KEY WELLS IN SOUTHERN CALIFORNIA

ELEVATION IN FEET — USGS DATUM

LOWER MOJAVE RIVER VALLEY (6-4000)
WELL 9N/E-3E2, SBB & M



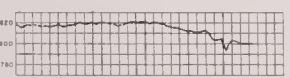
WELL 9N/3E-12G1, SBB & M



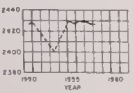
MIDDLE MOJAVE RIVER VALLEY (6-4100)
WELL 9N/2W-19B1, SBB & M



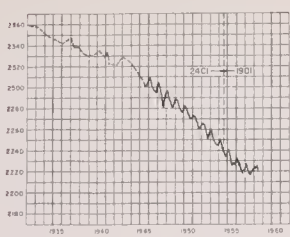
UPPER MOJAVE RIVER VALLEY (6-4200)
WELL 4N/3W-6B1, SBB & M



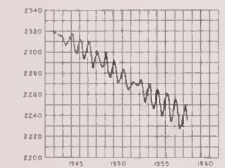
ANTELOPE VALLEY (6-4400)
CHAFFEE BASIN (6-4404)
WELL 32S/36E-2D1, MD & B M



LANCASTER BASIN (6-4405)
WELLS 7N/11W-24C1, 7N/10W-19D1, SBB & M



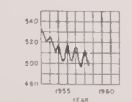
WELL 7N/12W-15F1, SBB & M



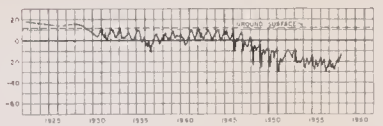
HARPER VALLEY (6-4700)
WELLS 10N/3W-32C1, 29M1, SBB & M



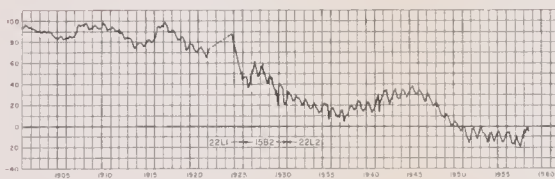
BORREGO VALLEY (7-2400)
WELL 10S/6E-21A1, SBB & M



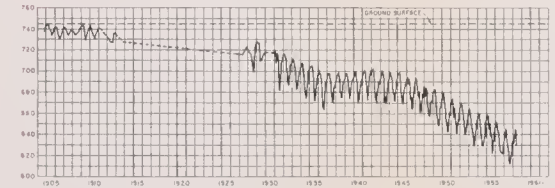
COASTAL PLAIN, ORANGE COUNTY (8-100)
EAST COASTAL PLAIN PRESSURE AREA (8-101)
WELL 6S/10W-6L2, SBB & M



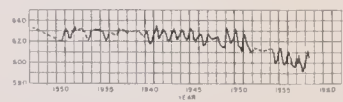
SANTA ANA FOREBAY AREA (8-102)
WELLS 4S/10W-22L1, 5B2, 22L2, SBB & M



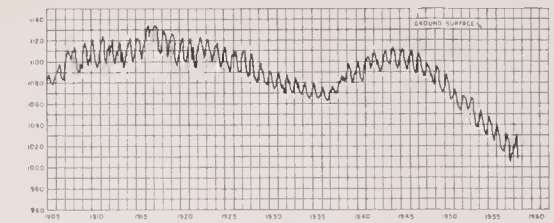
UPPER SANTA ANA VALLEY (8-200)
CHINO BASIN (8-201)
WELL 2S/BW-4P1, SBB & M



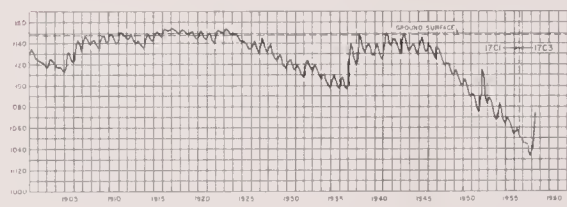
WELL 2S/7W-22K1, SBB & M



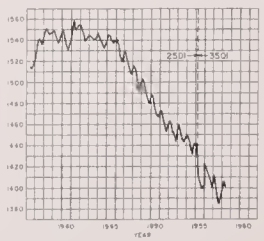
BUNKER HILL BASIN (8-206)
WELL 1N/4W-35L1, SBB & M



WELLS 1S/3W-17C1, C3, SBB & M



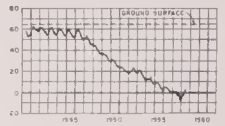
SAN JACINTO VALLEY (8-500)
WELLS 4S/1W-2501, 3501, SBB & M



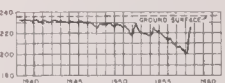
TEMECULA VALLEY (9-500)
MURRIETA BASIN (9-501)
WELLS 7S-3W-17P4, 17P5, SBB & M



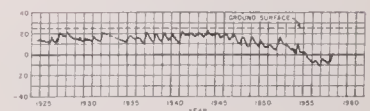
SAN LUIS REY VALLEY (9-700)
MISSION BASIN (9-701)
WELL 11S/4W-9E1, SBB & M



BONSALL BASIN (9-702)
WELL 10S/3W-11G1, SBB & M

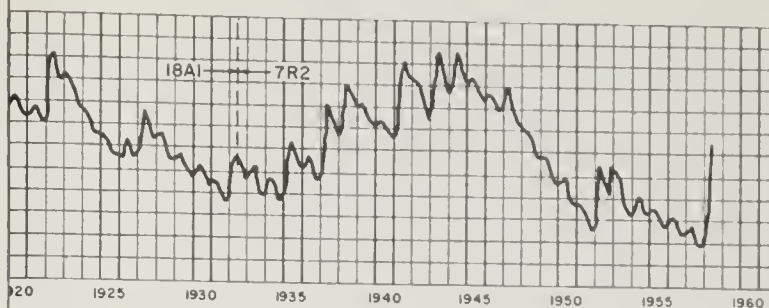


TIA JUANA VALLEY (9-1900)
WELL 19S/2W-4A13, SBB & M

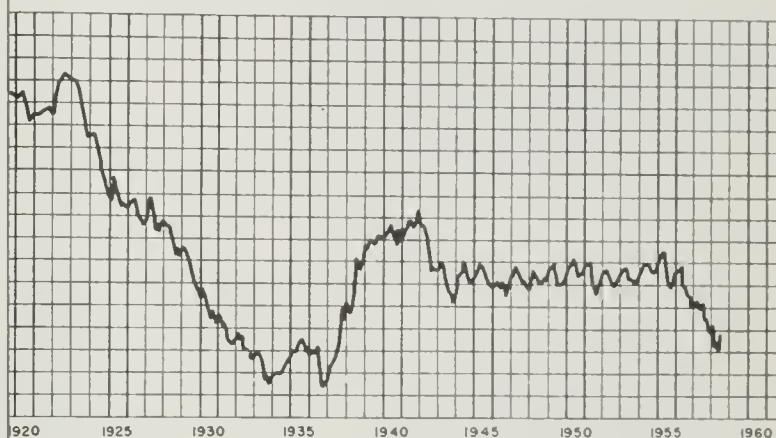


FLUCTUATION OF WATER LEVELS
AT KEY WELLS IN SOUTHERN CALIFORNIA

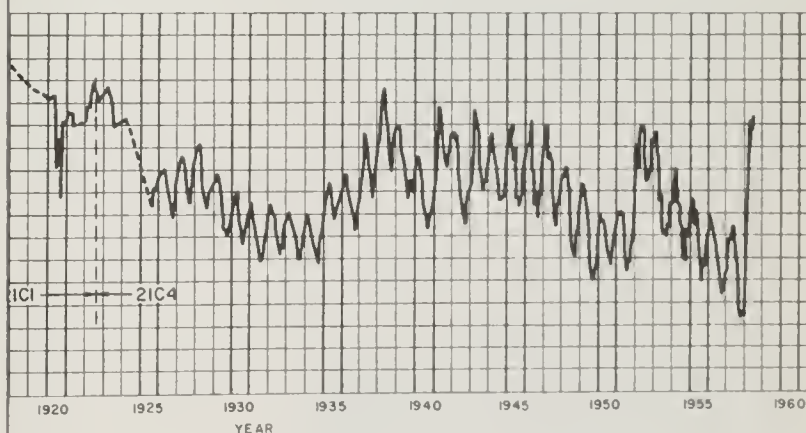
SAN GABRIEL VALLEY (4-13.00)
 MAIN SAN GABRIEL BASIN (4-13.01)
 WELLS 1S/10W-1BA1, 7R2, S.B.B. & M.



PASADENA SUBAREA (4-13.03)
 WELL 1N/12W-20B1, S.B.B. & M.



SANTA ANITA SUBAREA (4-13.04)
 WELLS 1N/11W-21C2, C1, C4, S.B.B. & M.



FLUCTUATION OF WATER LEVELS
 AT KEY WELLS IN SOUTHERN CALIFORNIA

ELEVATION IN FEET — USGS DATUM

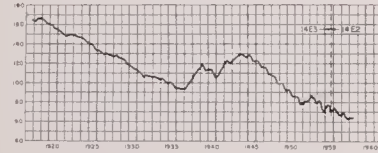
SALINAS VALLEY (3-400)
PASO ROBLES BASIN (3-406)
WELL 25S/2E-26K1, MDB & M



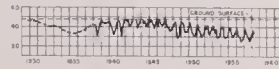
ARROYO GRANDE GROUP (3-1100)
ARROYO GRANDE BASIN (3-1101)
WELL 32S/1E-28G1, MDB & M



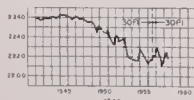
SANTA MARIA RIVER VALLEY (3-1200)
WELLS 10N/54W-14E3, E2, SBB & M



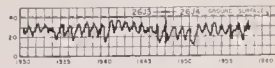
WELL 10N/35W-7F1, SBB & M



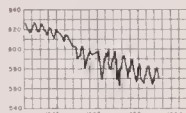
CUYAMA RIVER VALLEY (3-1300)
WELLS 10N/25W-30F1, P1, SBB & M



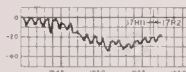
SANTA YNEZ RIVER VALLEY (3-1500)
LOWPOC SUBAREA (3-1501)
WELLS 7N/35W-26 J3, J4, SBB & M



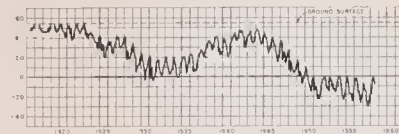
SANTA YNEZ SUBAREA (3-1504)
WELL 6N/30W-6A1, SBB & M



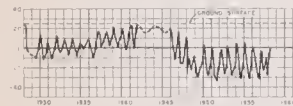
SOUTH COASTAL BASINS
SANTA BARBARA COUNTY (3-1600)
GOLETA BASIN (3-1601)
WELLS 4N/28W-17N1, R2, SBB & M



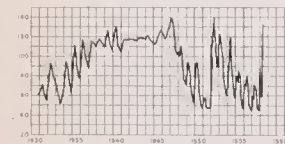
SANTA CLARA RIVER VALLEY (4-400)
OXNARD PLAIN PRESSURE AREA (4-401)
WELL 1N/22W-3F4, SBB & M



WELL 1N/22W-2J1, SBB & M



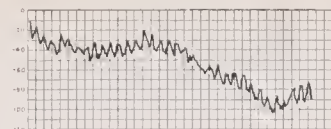
OXNARD PLAIN FOREBAY AREA (4-402)
WELL 2N/21W-6P1, SBB & M



WELLS 2N/22W-23O1, K3, SBB & M



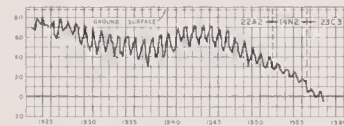
COASTAL PLAIN, LOS ANGELES COUNTY (4-1100)
WEST COAST BASIN (4-1102)
WELL 4S/13W-2H3, SBB & M



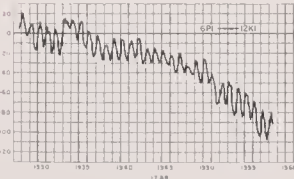
WELLS 3S/14W-29H1, O3, SBB & M



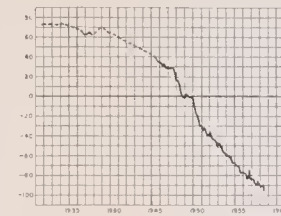
CENTRAL COASTAL PLAIN PRESSURE AREA (4-1103)
WELLS 3S/12W-22A2, 14N2, 23C3, SBB & M



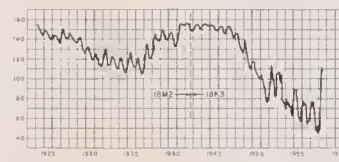
WELLS 4S/12W-6P1, 4S/13W-12P1, SBB & M



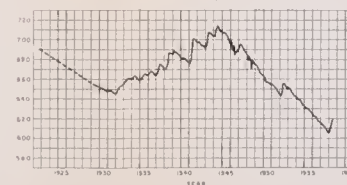
LOS ANGELES FOREBAY AREA (4-1104)
WELL 2S/13W-10A1, SBB & M



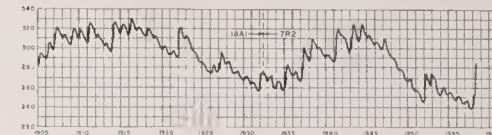
MONTEBELLO FOREBAY AREA (4-1105)
WELLS 2S/11W-18M2, K3, SBB & M



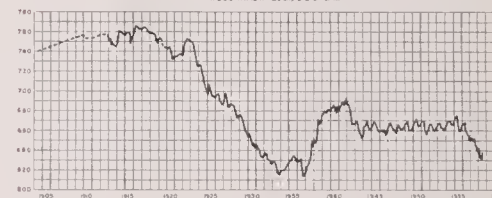
SAN FERNANDO VALLEY (4-1200)
SAN FERNANDO BASIN (4-1201)
WELL 2N/15W-22C1, SBB & M



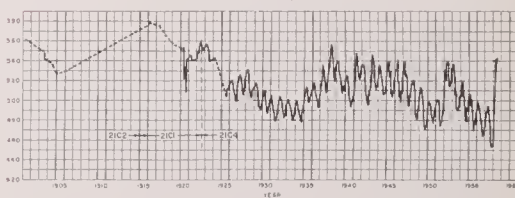
SAN GABRIEL VALLEY (4-1300)
MAIN SAN GABRIEL BASIN (4-1301)
WELLS 1S/10W-18A1, 7R2, SBB & M



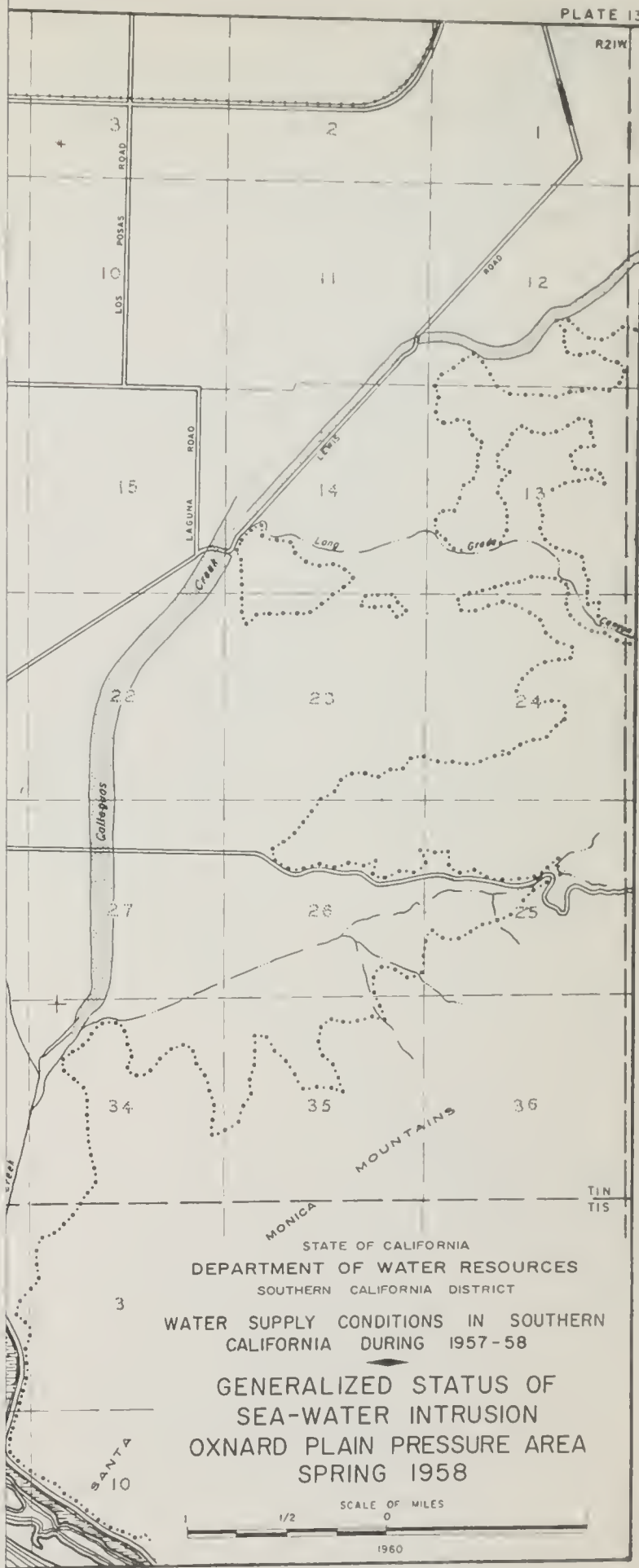
PASADENA SUBAREA (4-1303)
WELL 1N/12W-20B1, SBB & M



SANTA ANITA SUBAREA (4-1304)
WELLS 1N/11W-21C2, CL4, SBB & M



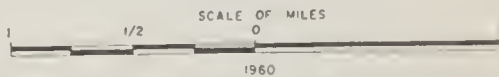
**FLUCTUATION OF WATER LEVELS
AT KEY WELLS IN SOUTHERN CALIFORNIA**



STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
SOUTHERN CALIFORNIA DISTRICT

WATER SUPPLY CONDITIONS IN SOUTHERN
CALIFORNIA DURING 1957-58

GENERALIZED STATUS OF
SEA-WATER INTRUSION
OXNARD PLAIN PRESSURE AREA
SPRING 1958





LEGEND

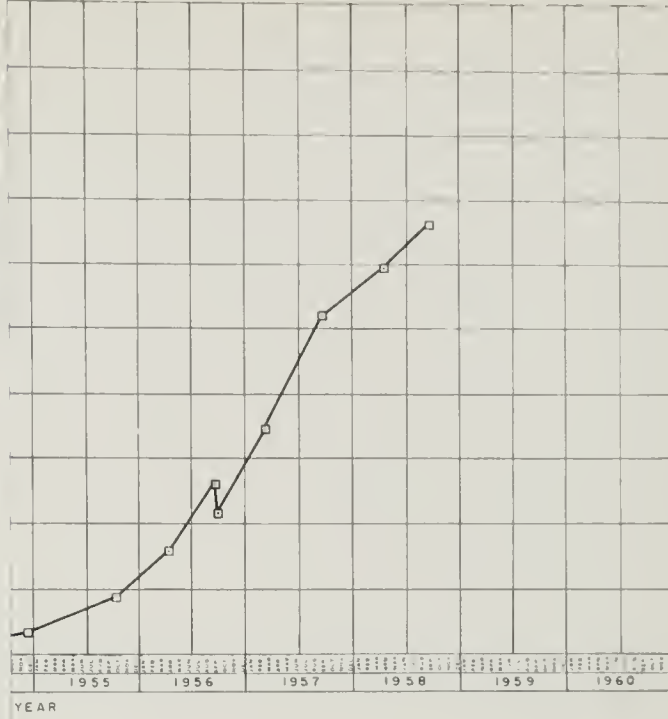
- CITY BOUNDARY
- NAVAL RESERVATION BOUNDARY
- EDGE OF NONWATER-BEARING AREA (HILLS)
- WELL USED FOR WATER QUALITY CONTROL WITH 1959 DATA
- WELL USED FOR WATER QUALITY CONTROL WITH DATA PRIOR TO 1958 ONLY
- WELL USED FOR WATER LEVEL CONTROL
- WELL USED FOR BOTH WATER QUALITY AND WATER LEVEL CONTROL
- 10- LINES OF EQUAL ELEVATION OF GROUND WATER AT WELLS IN THE OXNARD AQUIFER, JUNE 1958
- 100- LINE OF EQUAL CHLORIDE ION CONCENTRATION IN WELLS IN THE OXNARD AQUIFER, SPRING 1958
- AREA GENERALLY UNDERLAIN BY GROUND WATER CONTAINING OVER 500 PARTS PER MILLION CHLORIDE ION CONCENTRATION IN SPRING 1958

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
SOUTHERN CALIFORNIA DISTRICT
WATER SUPPLY CONDITIONS IN SOUTHERN CALIFORNIA DURING 1957-58

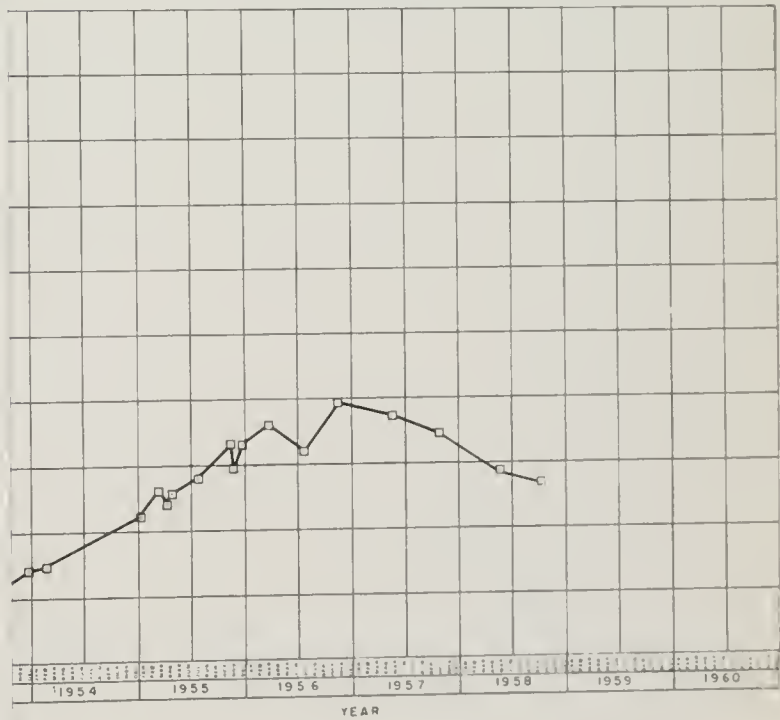
GENERALIZED STATUS OF
SEA-WATER INTRUSION
OXNARD PLAIN PRESSURE AREA
SPRING 1958

SCALE OF MILES
0 1/2 1
1960

RANGE COUNTY (8-100)
 PRESSURE AREA (8-100)
 6L2, S.B.B. & M

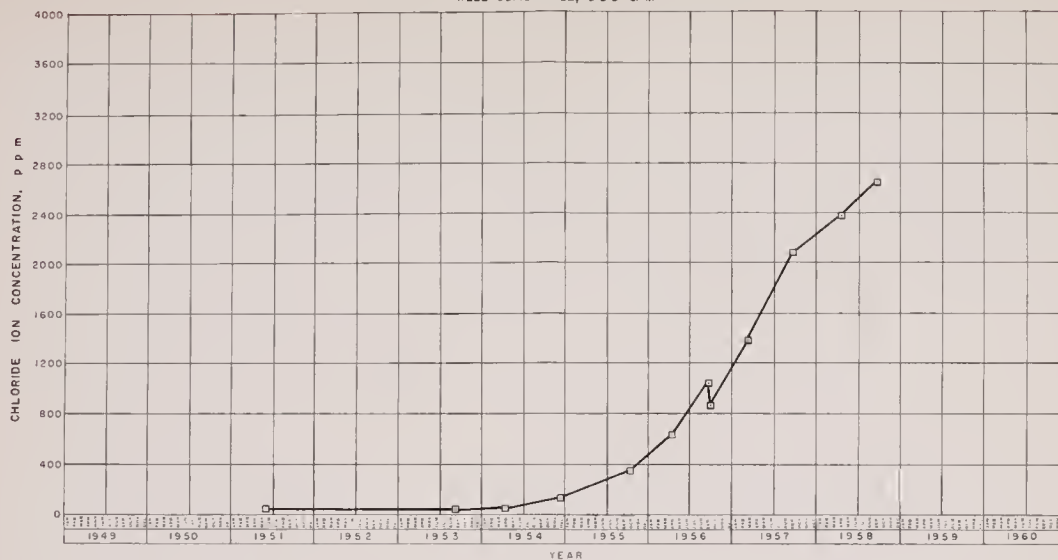


COASTAL PLAIN, LOS ANGELES COUNTY (4-1100)
 WEST COAST BASIN (4-11.02)
 WELL 35/14W-3001, S.B.B. & M.

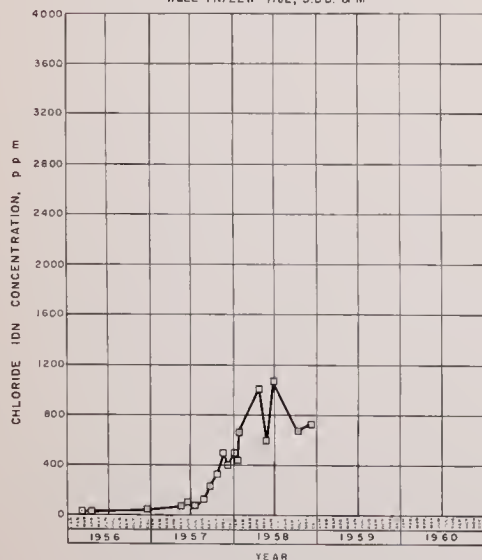


CONCENTRATION IN SELECTED WELLS

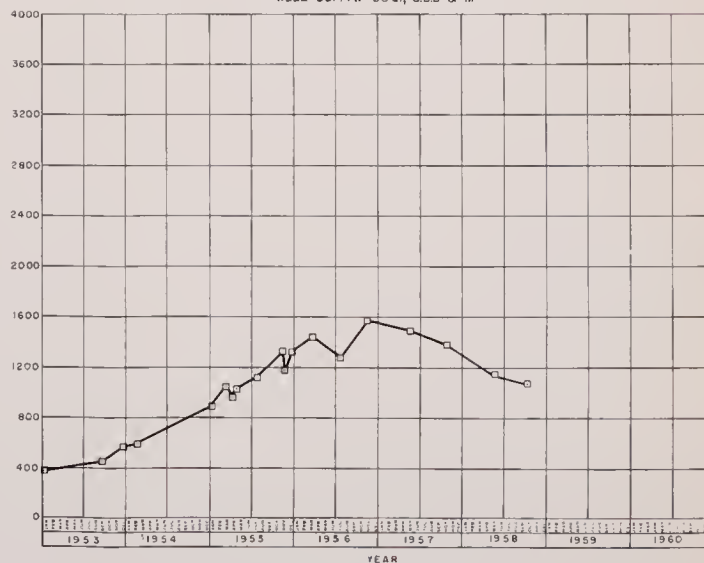
COASTAL PLAIN, ORANGE COUNTY (8-100)
EAST COASTAL PLAIN PRESSURE AREA (8-100)
WELL 6S/10W-6L2, S.B.B. & M



SANTA CLARA RIVER VALLEY (4-400)
OXNARD PLAIN PRESSURE AREA (4-400)
WELL 1N/22W-17J2, S.B.B. & M

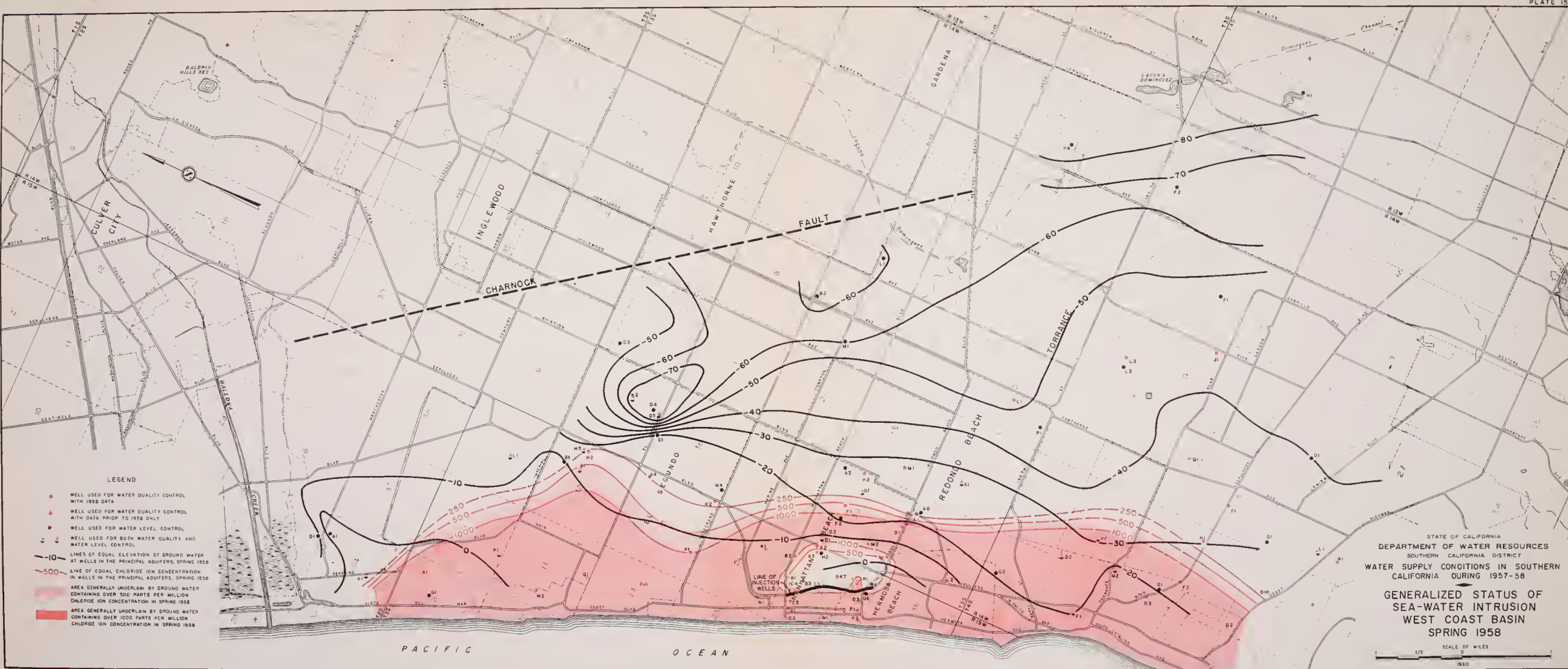


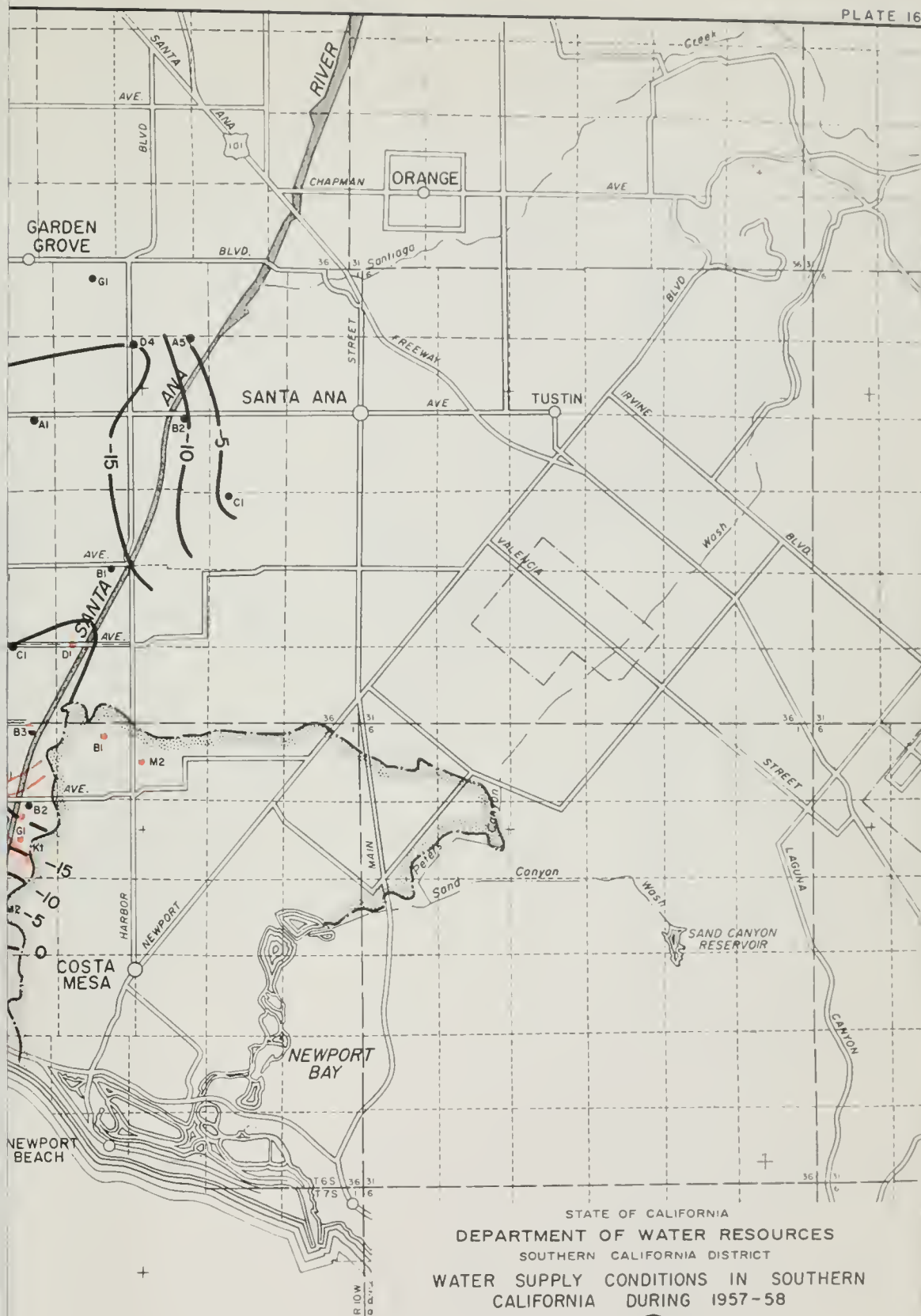
COASTAL PLAIN, LOS ANGELES COUNTY (4-1100)
WEST COAST BASIN (4-1100)
WELL 3S/14W-30Q1, S.B.B. & M



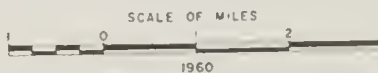
FLUCTUATIONS OF CHLORIDE ION CONCENTRATION IN SELECTED WELLS

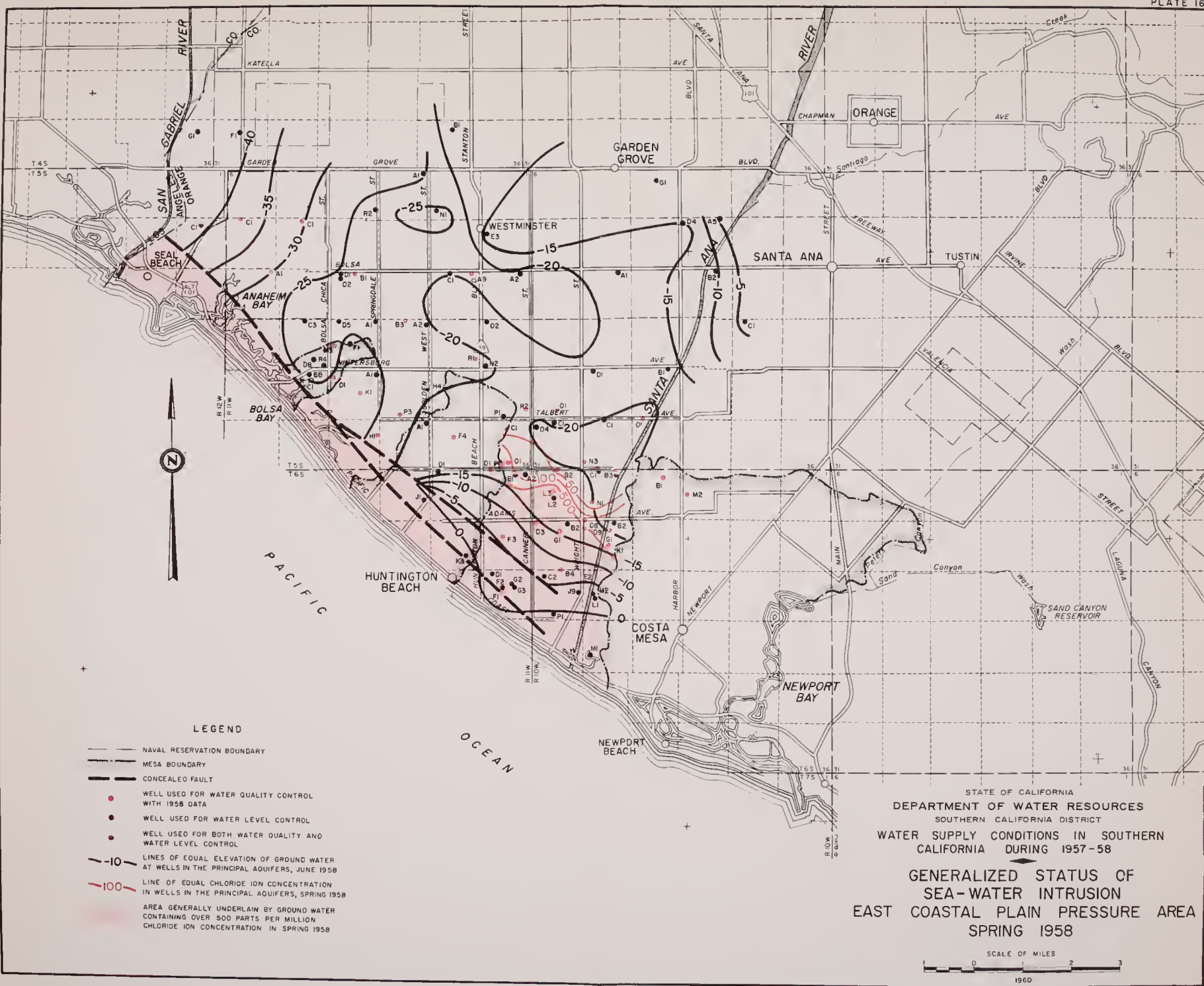






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